

Attachment 1

Statement of Work

DTFASO-10-R-00140

**CONSTRUCTION OF A CONCRETE PLATAFORM AND
A HAZARDOUS MATERIALS STORAGE BUILDING FOR THE
MIAMI AIR ROUTE TRAFFIC CONTROL CENTER, MIAMI, FLORIDA**



Miami Air Route Traffic Control Center
Miami, Florida
**CONSTRUCT HAZARDOUS MATERIAL STORAGE
BUILDING
SPECIFICATIONS**

**JUNE 14, 2010
SPECIFICATION FAA-ZMA-900814**

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ATO Tech Ops Engineering Services
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SECTION 01010 SUMMARY OF WORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Scope of Work - These specifications, together with the referenced specifications, standards, and drawings specified in the contract documents cover the requirements for all work associated with installation of a hazardous materials storage building:

1. Procure a hazardous material storage building
2. Construct Pad prepared for anchorage and provide ramp access
3. Provide new branch circuit 2 pole 40 ampere from the pump house

The General Contractor (GC) typically work during day times, 0700 AM to 0430 PM. Work hours will be coordinated prior to the pre-construction meeting. Extensive coordination between the GC and FAA personnel shall be required at all times in order to maintain an operational facility. **Prospective bidders are strongly recommended to perform a site visit to assess the actual conditions before submitting a bid. Site visits should be arranged thru the Contracting Officer's Office.**

- B. FAA Holiday Moratorium - No work shall be scheduled or take place during the week of and the weekend preceding and following: The Thanksgiving, Christmas, and New Years Holidays. Only emergency work to restore critical services to the Facility will be considered and a moratorium waiver must be submitted and approved. The moratorium period will not be counted against the contract construction duration of the project.
- C. Intent of Specifications - This specification identifies all material, labor, and equipment required to perform this work. All work performed and all materials and equipment used are subject to approval by the Contracting Officer (CO) and /or the Resident Engineer (RE). This shall include but is not limited to inspection, scheduling, reporting and submittals.
- D. Title - Titles to division and sections of the specifications and notes and titles on drawings referring to subcontractors, division of work by trade, or type of work, are introduced merely for convenience in reading the specifications and drawings and do not imply any separate contractual arrangements of work assignments. Such separations into titled divisions and sections shall not operate to make the Government an arbiter to establish subcontract limits between the contractor and subcontractors, or between the subcontractors themselves.
- E. Contract Documents - The drawings, as shown on the "List of Drawings" in Attachment 2 in each specification package, General, Architectural, Mechanical, Electrical, and Southern Standards, all form a part of the construction requirements for this project. The renovation of these systems shall be in accordance with the lines and grades shown on the drawings. The Contractor shall not use dimensions scaled from drawings. All dimensions shown on the drawings shall be field verified by the contractor prior to any modifications and fabrications. Any discrepancies between the drawings and specifications and the existing conditions shall be referred to the CO for adjustment before any work affected is performed.

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F. Precedence of Contract Documents - In the event of a difference between the following contract provisions, the order of precedence to determine which provision shall govern is:

1. Contract Clauses and Provisions
2. Project Specifications
3. Project Drawings

Any discrepancies between the contract provisions, the specifications and the contract drawings shall be referred to the CO for a written determination in accordance with Contract Clause entitled Order of Precedence.

G. Contracting Officer -The term "Contracting Officer" (CO) as used herein denotes the person designated to act on behalf of the Government in the performance of this contract. Where reference is made to "Federal Aviation Administration" (FAA), "Resident Engineer" (RE), "Contracting Officer's Representative" (COR), or the like, this shall mean the Contracting Officer or his/her authorized representative.

H. Contractor Superintendence - In accordance with Contract Clause entitled SUPERINTENDENCE BY THE CONTRACTOR, the Contractor shall at all times during performance of this contract and until the work is completed and accepted, directly superintend the work or assign and have on site a competent superintendent with the authority to act for the Contractor.

The Contractor shall submit a Project Organizational Chart with the key personnel identified and their qualifications for the Government's review and approval.

1.2 SPECIAL REQUIREMENTS

A. Asbestos Containing Materials. - **No new materials supplied by the contractor for this construction shall contain asbestos or lead-based products.** The contractor shall verify that all materials, including those supplied by third parties, are asbestos free and/or lead-based free materials.

1. Contractor certification requirements. - The contractor shall provide to the Contracting Officer (CO) a signed and notarized document stating that to the best of his/her knowledge, no asbestos containing or lead-based materials were used during the construction, renovation, and/or modernization of this facility.
2. Material Data Safety Sheets. - The contractor shall submit Material Data Safety Sheets (MSDS) with all submittals for review and approval by the Contracting Officer. New materials found to contain asbestos and/or lead-based products will be automatically disapproved. Copies of all MSDS sheets shall be provided to the facility FAA personnel for the building records. The contractor shall comply with all health and safety provisions outlined in each MSDS and shall follow all OSHA guidelines regarding personnel protection.
3. Hazardous materials. - If the FAA RE suspects the presence of asbestos or lead-based products in the new materials, the FAA will sample the suspect material to verify that no asbestos containing material or lead-based material were used. If these materials are found to contain asbestos or lead-based products, the cost of the survey and all subsequent removal/replacement of any hazardous materials shall be at the contractors' expense.

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- B. Work plan and scheduling. – Prior to the Contracting Officer issuing the Notice To Proceed (NTP), the contractor shall submit for approval a plan and schedule of his work. This schedule shall include all of the requirements as defined in Section 01042 of this specification.
- C. Sequence of work. - The contractor shall be responsible for scheduling all aspects of the work and coordinating among the different trades involved in the project. The contractor shall follow the guidelines outlined in the sequence of work as described in the contract drawings. The Federal Aviation Administration has developed a list of milestones that the contractor shall be required to meet.
- D. Construction Activities and Milestones. – Construction Activities and Milestones below shall be included in the submitted schedule. They are provided for guidance, but are not intended to direct how and when contract activities shall be ordered or take place in the submitted schedule.
1. SUBMITTAL APPROVAL
 2. ORDER HAZMAT BUILDING
 3. NOTICE TO PROCEED
 - a. Scheduled by the FAA's CO
 4. START SITE PREPARATION
 5. COMPLETE INSTALLATION
 6. REMOVE PERSONNEL AND EQUIPMENT
 7. CLOSE JOB
- E. Driveway Closures - Contractor shall maintain access to the loading dock at all times.

END OF SECTION 01010

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SECTION 01030

SITE ACCESS, CONSTRUCTION LIMITS, USE OF FACILITIES AND WORK HOURS

PART 1 – GENERAL

1.1 SUMMARY

- A. Existing facility operations. - Construction/demolition shall in no way interfere with Air Traffic Control Operations. The ARTCC is a 24-hour, seven day a week facility. Extreme care shall be exercised so as not to cause any interference or interruption of service from this facility. Controller functions are vital to the safety of the flying public. It is absolutely mandatory that the contractor protect FAA personnel and existing FAA communication, electrical and mechanical equipment both inside and outside buildings from damage caused by impact, water, debris, dust or odor. The contractor shall have the overall responsibility for the performance and enforcement of all forms of protection within the ARTCC premises against any damages due to work performed under this contract. Any damages incurred, as a result of construction activity during the performance of this contract will be repaired/replaced immediately by the contractor at no cost to the FAA.

Any work or activity that may impact the National Airspace System (NAS), such as work on critical equipment or circuits, will require coordination with the Contractor Office Representative (COR). The COR will prepare and submit a work or activity specific "Risk Assessment" for the facility's review and approval. This process may take one week to complete. Typically, this type of work or activity is performed from midnight to 05:00 am and/or on weekends.

B. Construction limits and access. -

1. Construction limits. - The contractor shall confine operations, activities, storage of materials and employee parking within the designated areas, as indicated on the construction staging plan, or as designated by the COR. Additional space the contractor deems necessary shall be obtained off site, at no additional cost to the Government.
2. Access. - Access route for the contractor, subcontractors, employees, deliveries, etc., shall through the main gate, or as designated by the COR. Access to all, parking areas, and loading dock shall be kept unobstructed. If temporary access obstruction is unavoidable, the contractor shall advise the COR immediately. Vehicles transporting materials shall not be loaded beyond the capacity prescribed by federal, state, or local laws. Obstruction of existing roadways, driveways, to the ARTCC is strictly prohibited.
3. Damage to site. - Damage to existing paving, lawns, curbs, sidewalks, and utilities caused by the contractor's activities shall be repaired immediately. Any damage to the building, interior or exterior, that are a result of the contractor's activities shall be repaired. The contractor shall pay all costs of repairs. After notice to proceed and prior to the commencement of construction, the contractor and COR shall conduct joint inspections of the existing areas affected by the construction. Existing damage or defects shall be noted and will be used as the basis for determination of damages caused by the contractor's operations.
4. The Contractors' employees shall not use the Cafeteria.

- C. Inspection of site by contractor. - It is strongly urged that the contractor carefully examine the premises to determine the extent of work and the conditions under which it must be done.

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D. Government use and access to premises. - The Government reserves the right to enter the construction area at any time for work inspection and for the operation of the facility.

E. Work hours. - All work hours, shifts, and overtime work shall be coordinated with the COR. Before commencing construction, furnish to the COR a statement of hours per day and days per week to normally be worked and approximate number of persons on the job for a normal work shift.

F. Security requirements.

1. Personnel List. - Contractor shall provide the COR with a list of contractor personnel who require access to the ARTCC. The list shall be submitted immediately after contract award. The list shall be kept current during the project and shall include the following:

Full name, including middle initial
Federal or State issued photo ID
Date of Birth
Place of Birth

2. Security Investigation and identification. - Contractor's personnel may be subject to security investigation by FAA. The contractor shall promptly complete all security forms provided by the CO. Contractor's personnel shall report to the FAA security guard at entrance to the facility and submit proper identification when signing in to obtain an FAA badge which will be worn on an outside garment, above the waist and below the neck, facing forwards, at all times while on the ARTCC premises. This badge shall be returned daily to the security guard when leaving the premises, unless otherwise noted.
3. Vehicle identification. - Vehicle identification tags will be issued for contractor and contractor's employees' vehicles that require access into the ARTCC site. The identification tags shall be displayed in the windshield of the vehicle at all times when the vehicle is on the site. The contractor shall be responsible for the collection and return of all vehicle tags that are no longer required.
4. Escort requirement. - Contractor is responsible to provide an escort for his employees. This will required a security background investigation by the FAA. Contractor's personnel shall not violate any security regulations pertaining to the ARTCC facility. Violators may be removed from the premises with the right to reenter revocable. Contractor's day-to-day work schedules in the classified areas shall be so arranged to allow for minimum escort.
5. Right to search. - Current procedures at FAA facilities include the "right to search." If in the judgment of the FAA a cause to search a vehicle or the person of personnel exists, such search will be made.
6. Replacement of lost identification. - The FAA will provide personnel badges and vehicle identification tags as described above. It is the contractor's responsibility to return these badges and tags daily and upon completion of the project. The contractor shall be liable to pay for any FAA badge or tag not returned or replaced at the completion of the work. The payment for lost I.D. will be \$10.00 for each and every tag or badge not returned or replaced, except for temporary badges.

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7. Physical Security. - At the end of each workday, the contractor shall secure all construction areas by closing and locking all doors and gates. The contractor is responsible for the security of the staging area, and shall provide the required measures at no additional expense to the government.

END OF SECTION 01030

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SECTION 01040: COORDINATION, LOCAL PERMITS AND TESTING

PART 1 – GENERAL

1.1 SUMMARY

- A. Project coordination. - It shall be the duty of the Contractor to prepare a detailed schedule of work and work layout to resolve conflicts and to assure coordination of the work by different trades.
- B. Weekly Meeting. - Coordination between the COR and Contractor shall take place weekly at the site. Special meetings will be scheduled if requested by either the COR or Contractor. The subjects to be discussed at the progress meetings shall included, but are not limited to, the following:

- Safety concerns/Issues
- Progress of Work
- Previous meeting action items/issues
- Field problems
- Material and Equipment delivery status
- Submittal status/schedules
- Progress planned during the upcoming week(s)
- Review of changes, and potential effects on the schedule
- Construction schedule revisions
- Schedule Revisions
- Other current business

The following persons will be expected to attend meetings; FAA COR, Prime Contractor Superintendent, Project Manager and Project Manager/Superintendents for other major trades.

- C. Facility Coordination Meeting. - Weekly coordination meeting shall take place between the facility managers, COR and the Contractor's Project Superintendent.
- D. Work Affecting Operational Systems. - The contractor shall coordinate all work which has any or may have any impact on any operational system within the facility through the COR. The contractor shall immediately cease any work that is adversely impacting the operation of the ARTCC and shall immediately repair or restore any portion of the operational system that has been damaged or suffered diminished performance as a result of the contractor's activities.
- E. Local permits and Coordination. - The Contractor will be responsible for obtaining and payment of all building fees, inspection fees, utility connection charges and any other fees or charges that may be incurred in the performance of this contract.
- F. Applicable documents. - The contractor shall comply with all local city, county, and state construction codes.

1.2 TESTING

- A. Contractor's responsibility. - Unless otherwise indicated as the responsibility of another identified entity, Contractor shall provide certified testing and inspection agencies, inspections, tests, and other quality-control services specified elsewhere in the Contract Documents and required by authorities having jurisdiction.
1. Where individual Sections specifically indicate that certain inspections, tests, and other quality-control services are the Contractor's responsibility, the Contractor shall employ and pay a qualified independent testing agency to perform quality-control services.

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- a. Where the Government has engaged a testing agency for testing and inspecting part of the Work, and the Contractor is also required to engage an entity for the same or related element, the Contractor shall not employ the entity engaged by the Government, unless agreed to in writing by the Government.
 2. The testing laboratory will furnish three copies of each report directly to the COR covering all of its determinations and conclusions. Reports will show all data customarily listed by the laboratory in reporting on quantities, qualities, and types of materials together with their correlation with the project and applicable Specification Section.
- B. Retesting - The Contractor is responsible for retesting where results of inspections, tests, or other quality-control services prove unsatisfactory and indicate noncompliance with Contract Document requirements, regardless of whether the original test was Contractor's responsibility.
1. The cost of retesting construction, revised or replaced by the Contractor, is the Contractor's responsibility where required tests performed on original construction indicated noncompliance with Contract Document requirements.
- C. Selection and payment. - The contractor shall pay for all testing. The contractor shall select and use a certified and qualified testing laboratory to perform the requirements of this contract. The American Association of Laboratory Accreditation shall certify the testing laboratory.
- D. Rejected materials or workmanship. - All materials or workmanship or both which have been rejected by the COR by reasons of failure to conform to the requirements of the Contract Documents shall be removed and replaced with new, acceptable materials by the contractor at the contractor's own expense. Contractor shall also pay for testing of new materials that have been installed in place of rejected materials.

END OF SECTION 01040

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SECTION 01042 CONSTRUCTION SCHEDULES

PART 1 – GENERAL

1.1 SUMMARY

- A. Description. - The work plan and schedule prepared by the contractor shall consist of a Gantt or Critical Path Method (CPM) chart(s) and logical narrative plan. The charts shall show all significant activities and shall include detailed activities when critical work is to be performed.

1.2 PRODUCTS

A. Diagrams -

1. Schedule shall indicate activity duration and the schedule shall include a date timeline.
2. Include construction activities, the submittal and approval of materials, samples and shop drawings, the procurement of critical materials and equipment, fabrication of special materials and equipment along with their installation and testing, and costs associated with each activity in the chart.

- B. Progress Schedules. - Within 30 calendar days of contract award, the contractor shall submit the schedule and work plan. **A Notice to Proceed will not be issued until the schedule is approved.**

- C. Software Files Schedules: Software file submissions may be accepted, if it can be read by software that the COR has already installed on their computer or if the contractor can provide a licensed copy of the scheduling software used to prepare the schedule file. The COR will get the software installed and will get it removed at the end of the project.

1.3 EXECUTION

- A. Review and Evaluation. - The Contractor shall participate in a review and evaluation of the proposed schedule with the Contracting Officer. Any revisions necessary as a result of the review shall be re-submitted for approval of the Contracting Officer within 14 days after the conference. The contractor for planning, organizing, and directing work, reporting progress, and requesting payment for work accomplished shall then use the approved schedule. If the contractor, thereafter, desires to make changes in the schedule, the Contracting Officer shall be notified in writing, stating the reasons for the change. If the Contracting Officer considers the change to be of a major nature, the contractor may be required to revise the schedule and submit it for approval, without additional cost to the government.
- B. Weekly Update. - The contractor shall meet with the COR at weekly intervals to discuss the construction progress. If the project is behind schedule and requires a change in the schedule, the contractor shall submit a revised schedule with a description of the delaying factors and their impact, and an explanation of corrective actions taken or proposed.
- C. Payment. - The monthly update shall show the activities or portions of activities completed during the reporting period, and their total value will be the basis for the contractor's periodic request for payment. Payment will be based on the total value of such activities completed or partially completed after verification by the Contracting Officer.

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D. Submission Requirements. - Schedule charts shall be on (minimum) 11" x 17" size paper. Update charts shall show the date of the latest revision. Schedule charts with revisions and monthly updates shall be submitted in three copies.

E. Requirements for Schedule Chart. -

1. Activities.- The significant activities to be included in the schedule chart shall include, but not limited to:
 - a) The milestones listed in 01010 1.2. D
 - b) Shall have at least 15 activities
 - c) The activities will have a cost for each activity.
 - d) Any system shutdowns or cut-over's
 - e) Any other significant activities that the contractor or FAA believes is necessary.
2. The diagram shall show a continuous activity flow from left to right. The diagram shall show the sequence in which the work is to be accomplished as planned by the Contractor
3. Dates shall be shown on the diagram for start of the project, any milestones required by the contract, and contract completion.
4. The critical path shall be clearly identified. Network activities shown shall include submittal and review of shop drawings and samples and procurement of materials and construction activities.
5. Government activities that affect progress shall be shown. These include but are not limited to: Notice-to-Proceed, approvals, and inspections.

F. Shutdown and Cut Over.

1. Electrical Systems. - New construction shall have no impact on the critical or essential electrical service at this facility. However, all electrical connections within live power panels will be scheduled with the COR at least 14 days in advance. All electrical connections to existing panels shall be coordinated with FAA personnel. Equipment shutdown and lock-out shall be accomplished by FAA personnel.
2. Startup - The contractor will complete initial startup testing

G. Acceptance and Warranties

1. The Contractor shall warranty material and equipment furnished by the various manufacturers in writing for period of two (2) years (or not less than the industry standard for the material specified, nor the manufacturer's standard warranty period, whichever is greater) on building systems finishes or equipment from the date of final project acceptance by the FAA. The cost of any extended warranties will be included in the contract sum.

END OF SECTION 01042

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SECTION 01300 SUBMITTALS

PART 1 – GENERAL

Applicable provisions of this Section and other provisions and requirements of the Contract Documents apply to all sections, except as modified in Sections of Divisions 2 through 16.

1.1 SUMMARY

Submit Shop Drawings, product data, samples, warranties, certificates, test reports and third party disposal letters as required by the contract documents.

1.2 RELATED REQUIREMENTS

- A. Section 01040: Coordination and Testing
- B. Section 01651: Materials and Equipment
- C. Section 01800: Closeout Procedures

1.3 SUBMITTALS

Submittals required include, but are not necessarily limited to, the following:

- A. Submittal schedule
- B. Construction progress schedule
- C. Submittal log

1.4 SUBMISSION REQUIREMENTS

- A. Number of Copies - Submit in ample time for approval before installation. Unless otherwise noted, submit a minimum of four (4) copies of documents. Send one to the Contracting Officer and the balance to the Resident Engineer (RE). The RE will retain Two (2) copies. If additional copies are required, provide the quantity and submit additional copies to meet this requirement.
- B. Time for Approval - Receive submittal approvals prior to starting the work. The government has 30 calendar days to respond to a submittal. All materials installed in the work shall match the approved submittals. After a submittal has been approved, the RE will permit no substitutions without written approval. No extension of Contract Time will be authorized because of failure to transmit to the RE sufficiently in advance of the Work to permit processing.

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- C. Submittal Approval - The checking, marking or approval of the submittal by the FAA shall not be construed as a complete check, but will indicate only that the product or method of construction and detailing is satisfactory. Approval will not relieve the contractor of the responsibility for compliance with the specifications or for any error that may exist. The Contractor shall be responsible for the dimensions and design of adequate connections, details, and satisfactory construction of all work. Possible approval actions taken by the FAA include:
1. Approved as submitted - If the RE marks a submittal "approved as submitted" each copy of the submittal will be identified as having received such approval by being stamped and dated. After submittal has been approved, the RE will permit no substitutions without written approval.
 2. Approved as noted - If the RE marks "approved as noted", the submittal is satisfactory contingent upon Contractor acceptance of corrections, notations, or both, and if accepted, does not require resubmittal.
 3. Not approved - If the RE marks "not approved", the submittal data does not meet job requirements and the Contractor must resubmit. If the submittal is disapproved, the Contractor shall resubmit the corrected material in the same quantity as specified for the original submittal. Correct disapproved submittals and resubmit for approval by the RE no later than 14 calendar days from their notification. Review and approval or disapproval of resubmittals will be completed in fourteen (14) calendar days.
 4. Submittal Schedule - Identify within the Contractor's Construction Schedule a schedule of submittals for shop drawings, material approval, etc., showing the dates when submittals will be submitted for the project.
 - a) Contents - On the schedule indicate the following information:
 - 1) Schedule date for submittal
 - 2) Related Section number.
 - 3) Submittal category (Shop Drawings, Product Data, or Samples).
 - 4) Name of the subcontractor (if applicable)
 - 5) Description of the part of the Work covered.
 5. Distribution - Following response to the initial submittal, print and distribute copies to the RE, Government, subcontractors, and other parties required to comply with submittal dates indicated. When revisions are made, distribute to the same parties. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.
 6. Schedule Updates - Revise the schedule after each meeting or activity where revisions have been recognized or made.

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- D. Construction Progress Schedule – The progress chart to be prepared by the Contractor pursuant to the Contract Clause entitled “SCHEDULES FOR CONSTRUCTION CONTRACTS” shall consist of network analysis system, or Gantt chart (barchart). The contractor shall be required to complete the work within the contract time limits after receipt of Notice to Proceed excluding the FAA holiday moratorium as specified in section 01010.

NO PHYSICAL CONSTRUCTION WORK AT THE SITE MAY TAKE PLACE UNTIL THE CONTRACTOR SUBMITS AND THE GOVERNMENT APPROVES THE SCHEDULE. Government review of schedule submittal(s) will not exceed 30 calendar days. Resubmittal, if necessary shall not exceed fourteen (14) calendar days.

- E. Schedule updates will be provided weekly. Changes for the current week may be hand written. Actual work completed that is more than one week old shall be updated and printed out. Changes to the early and late start times and early and late finish times for scheduled activities will be updated weekly.
- F. Submittals - Submit shop drawings, material and equipment lists, and all other data required under various headings of these specifications necessary to permit commencement of work. RE will return the submittals within 30 calendar days after receipt, indicating approval or disapproval.
- G. Submittal Preparation - Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.
1. Transmittals - transmittal letters identifying the contents of the submittal shall accompany all submittals. It shall be clearly indicated on the transmittal letter with a statement and signature of the Contractor that the submittal item was verified for compliance with the contract requirements and approved by the Contractor. Transmittal letters shall consist of one original.
 2. Contents - Submittals shall be complete and detailed and assembled into sets. Lack of completeness or clarity or inadequate description will be justification for disapproval. Submittals shall bear the following information:
 - a) Name of project or facility and contract number;
 - b) Date of submission;
 - c) Contract drawing number and latest revision;
 - d) Specification page and paragraph number;
 - e) Name of contractor and subcontractor or supplier/manufacturer;
 - f) Clearly identified contents and location of work;
 - g) Any proposed variances to specification requirements;
 - h) Contractor's approval certifying he checked and coordinated the work of other trades.

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1.5 SHOP DRAWINGS

- A. Applicable Documents -
- B. Presentation: Present drawings in a clear and thorough manner. Identify details by reference to sheet and detail, building wing and section shown on contract drawings.
 - 1. Submit newly prepared information drawn accurately to scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not a Shop Drawing.
 - 2. Shop Drawings include fabrication and installation Drawings, setting diagrams, schedules, patterns, templates and similar Drawings.
- C. Contents - Provide the following information on each submittal:
 - 1. Submittal number (paragraph 2.1 of this Section) and identify as "Part A" or "Part B" item
 - 2. Date of submission
 - 3. Name of project and facility (full name)
 - 4. Name of Contractor or Subcontractor
 - 5. Reference to drawing number (with revision, if applicable) and/or specification section
 - 6. Clearly identify contents and location of work.
 - 7. Contractor's approval certifying he checked and coordinated the work of other trades.
 - 8. Dimensions.
 - 9. Identification of products and materials included by sheet and detail number
 - 10. Compliance with specified standards.
 - 11. Notation of coordination requirements
 - 12. Notation of dimensions established by field measurement.
 - 13. Sheet Size: Except for templates, patterns and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 36 by 48 inches.
- D. Submittal - Submit blue- or black-line prints for the RE's review. Submit five copies, of which the RE will retain three.
 - 1. One of the prints returned shall be marked up and maintained as a "Record Document."
 - 2. Do not use Shop Drawings without an appropriate final stamp indicating action taken.

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1.6 PRODUCT DATA

- A. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information, such as manufacturer's installation instructions, catalog cuts, Material Safety Data Sheets (MSDS), standard color charts, roughing-in diagrams and templates, standard wiring diagrams, and performance curves, for all materials brought on site.
- B. Preparation
 - 1. Clearly mark or highlight each copy to identify pertinent site specific products or models the Contractor intends to use
 - 2. Highlight/clearly indicate all performance characteristics and capacities
 - 3. Highlight/clearly indicate all dimensions and clearances required

Note: If the submittal is not clearly marked, regarding the above pertinent data, the submittal will be returned marked "DISAPPROVED".

1.7 WARRANTIES/GUARANTIES

- A. Assemble two (2) copies with original signatures of warranties executed by each of the respective manufacturers, suppliers, and subcontractors into a warranty book and prepare a Table of Contents.
- B. Additional Data - Provide complete information for each item, include the following:
 - 1. Product or work team
 - 2. Firm, with name of principal, address, and telephone
 - 3. Scope
 - 4. Effective dates of warranty based on Final Acceptance of the item.
 - 5. Information for owner's personnel on proper procedures to evoke the warranty in case of failure and instances which might affect the validity of warranty
- C. Warranties - Effective after project completion and acceptance by the FAA.

1.8 CERTIFICATES

Assemble certificates executed by each of the respective manufacturers, suppliers, and subcontractors.

- A. Additional Data - Provide complete information for each item to certify compliance with contract documents.
 - 1. Product or work item
 - 2. Firm, with name of principal
 - 3. Scope of compliance
 - 4. Signature by an officer of the manufacturer or other individual authorized to sign documents on behalf of the company.

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PART 2 – MATERIAL

NOT USED

PART 3 – EXECUTION

3.1 GENERAL

Submittals are required for, but not limited to, the items listed in the specifications or on the drawings. The following is a partial list of submittals required: Schedules, Manufacturer's Literature, Shop Drawings, Samples, Test Reports, Warranties, Certificates, Design Calculations, MSDS, and Installation Instructions. This list should not be construed as a complete list of all submittals required. Submittal dates shall comply with this specification unless a more stringent date is specified. Substitutions and all requested changes will require a submittal.

3.2 SCHEDULE FOR CRITICAL SUBMITTALS

Process after the construction contract has been awarded and prior to NTP:

All Critical Submittals are due 30 calendar days after the contract has been awarded. See below for a list of critical submittals. The construction Notice to Proceed (NTP) will not be issued until all critical submittals are approved. All other submittals shall be submitted and approved prior to installation or construction. Critical submittals include the following:

1. Section 01300 - Construction Schedule
2. Section 1333423 Prefabricated Hazardous Material Building
3. Division 16

No later than two weeks after the contract has been awarded, the Contractor shall be available to participate in a meeting/telecom with the Contracting Officer, Resident Engineer and Office Project Engineer to discuss and coordinate the following:

- 1) Contractor's FAA point of contact for submitting the Critical Submittals.
- 2) Discuss the submittal process and forms.
- 3) Discuss process and forms for request of FAA security badges.
- 4) Discuss the proposed date for Notice to Proceed (NTP)

PART 4 – QUALITY ASSURANCE

NOT USED

***** END OF SECTION *****

SECTION 01651 MATERIALS AND EQUIPMENT

PART 1 - GENERAL

1-1 SUMMARY

- A. General. - Material and equipment incorporated into the work shall conform to applicable specifications and standards and comply with size, make, type and quality specified, or as specifically approved in writing by the COR. Manufactured and fabricated products shall be designed, fabricated and assembled in accordance with the best engineering and shop practices. Like parts of duplicate units shall be manufactured to standard sizes and gages and shall be interchangeable. Two or more items of the same kind shall be identical and manufactured by the same manufacturer. Products shall be suitable for service conditions. Equipment capacities, sizes and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing. Do not use material or equipment for any purpose other than for which it is designed or specified. Furnish and install products specified, under options and conditions for substitution stated in this section.
1. Manufacturer's instructions. - When contract documents require that installation of work shall comply with manufacturer's printed instructions, copies of such instructions shall be distributed to parties involved in the installation, including two copies to the COR. Maintain one set of complete instructions at the job site during installation and until completion. Products shall be handled, installed, connected, cleaned and conditioned in strict accordance with such instructions and in conformity with specified requirements. If job conditions or specified requirements conflict with manufacturer's instructions, the contractor shall consult with the COR for further instructions. All work shall be performed in accordance with manufacturer's instructions. No preparatory step or installation procedure shall be omitted unless specifically modified or exempted by contract documents.
 2. Transportation and handling. - Products shall be delivered in undamaged condition, in manufacturer's original containers or packing, with identifying labels intact and legible. Shipments shall be inspected to ensure compliance with requirements of contract documents and approved submittals, and products are properly protected and undamaged immediately on delivery. Provide equipment and personnel to handle products by methods to prevent soiling or damage to products or packing.
 3. Storage. - Unless specified, products shall be stored in accordance with manufacturer's instructions, with seals and labels intact and legible. Products subject to damage by the elements shall be stored in weather tight enclosures.
 4. Temperature. - Temperature and humidity shall be maintained within the ranges required by the manufactures instructions. Fabricated products shall be stored above the ground, on blocking or skids to prevent soiling or staining. Products that are subject to deterioration shall be covered with impervious sheet coverings and adequate ventilation shall be provided to avoid condensation.

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5. Substitutions. - A separate request for each substitution shall be submitted. Each request shall be supported with complete data substantiating compliance of proposed substitution with the requirements stated in the contract documents. Each request shall include product identification, manufacturer's literature including address, product description, reference standards and performance and test data. Samples shall be submitted as applicable. An itemized comparison of the proposed substitution with the product specified shall be included. The following information shall also be included: data relating to changes in the construction schedule; list of changes required in other work or products; and accurate cost data. Substitute products shall not be ordered or installed without written acceptance. In making a formal request for substitution, the contractor represents that he has investigated the proposed products and has determined that it is equal to or superior in all respects to that specified. The contractor ascertains that he will provide same warranties or bonds for substitutions as for product specified. That he will coordinate installation of accepted substitution into work to be complete in all respects; that he waives claims for additional costs caused by substitution which may subsequently become apparent; and that cost data is complete and includes related costs under his contract. Primarily, an "or equal" product will not be considered a substitution. If an actual substitution is accepted, it shall be done only by formal contract modification and not by a submittal approval.
6. New equipment and materials - All contractor supplied materials and equipment that will remain in the government's custody after contract completion, shall be new. Refurbished and or used equipment and materials are disallowed for construction purposes under this contract.

END OF SECTION 01651

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SECTION 01652 PROTECTION OF WORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Requirements Included. - It shall be the Contractor's responsibility to provide protection of work from weather, physical damage, improper use, and other adverse natural conditions. It shall be the responsibility of the Contractor to replace any damaged work including finishes, material, and equipment.

1.2 RELATED REQUIREMENTS. - The Respective Section of the Specification covering items of work.

Section 01651: Materials and Equipment

Section 01710: Cleaning

A. Protection during Installation.

1. Sleeves. - Provide watertight closures for sleeve openings below grade.
2. Building Openings. - Provide protection of temporary openings in the building to completely protect the contents and enable work to progress, during winter and all weather conditions. The method and means shall be subject to approval by the COR.
3. Base Materials. - Provide protection of base materials to receive finishes from physical damage.
4. Protection after Installation. - Provide protection of installed products and finished surfaces to prevent damage from subsequent operations. Remove when no longer needed, prior to completion of work.
5. Floors and Stairs. - Protect finished floors and stairs from dirt and damage:
 - (a) In areas subject to foot traffic, secure heavy sheathing in place.
 - (b) For movement of heavy products, lay planking or similar materials in place.
 - (c) For storage of products, lay tight wood sheathing in place.
6. When some activity must take place in order to carry out the contract, obtain and abide by recommendations of installer for protection of surface. Remove upon completion of the activity.

END OF SECTION 01652

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SECTION 01710 CLEANING

PART 1 - GENERAL

1-1 SUMMARY

The scope of this project will be performed in a partially occupied special use environment. Daily cleaning and protection shall be a requirement. All prospective bidders are encouraged to visit the project site to ascertain the criticality of maintaining a clean litter free environment.

A. Requirements Included.

1. Execute cleaning during the progress of work. This includes but not limited to the following:
 - a) Remove waste packaging and waste construction material.
 - b) Remove temporary protective covers and barriers at the end of each shift.
2. Execute cleaning for final inspection.
3. Execute cleaning at completion of the work.

1-2 RELATED REQUIREMENTS

Section 01651: Materials and Equipment
Section 01800: Contract Closeout.

1-3 PRODUCTS

- A. Materials. - Use only those cleaning materials recommended by the manufacturers of the surface being cleaned so as not to create hazards to health or property.

1-4 EXECUTION

- A. Disposal Requirements. - Conduct cleaning and disposal operations to comply with codes, ordinances, regulations, and anti-pollution laws.
- B. Final Cleaning.
1. Employ skilled workmen for final cleaning.
 2. Remove grease, mastic, adhesive, dust, dirt, stains, fingerprints, labels, and other foreign materials from visible interior and exterior surfaces.
 3. Ventilating system:
 4. Clean permanent filters and replace disposable filters if units were operated during construction. Do not operate blowers and coils without filters during construction.
 5. Broom clean exterior paved surfaces, repair damaged sod areas with sod and rake. Clean other surfaces of the grounds.
 6. Prior to final completion. Contractor shall conduct an inspection of interior and exterior surfaces, and all work areas to verify that the entire work is clean.
- C. During Construction. - Maintain all areas under Contractor's control free of extraneous debris. Conduct a specific maintenance program to prevent accumulation of debris at the construction site, storage and parking areas, and along access roads and haul routes.
- D. ARTCC Operational Areas. - Clean up after each work shift.

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- E. Debris Collection. - Provide containers for debris deposit and schedule periodic collections and disposal of debris. Provide additional collections whenever the periodic schedule is inadequate to prevent accumulation.

END OF SECTION 01710

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SECTION 01720 OPERATIONS AND MAINTENANCE MANUALS

PART 1 – GENERAL

1.1 SUMMARY

- A. The Construction Contractor shall furnish five original copies of the manufacturers' Operations and Maintenance (O&M) manual for equipment as specified. One complete O&M data manual shall be furnished prior to the time that equipment acceptance tests are performed. The remaining O&M data shall be furnished before the contract is completed. O&M data may be prepared by the equipment manufacturer and shall be submitted by the Contractor to the Contracting Officer's Representative (COR) as specified.

O&M instructions shall be legible and easy to read, with large drawings (when used), folded into the manual. Specific O&M data to be submitted shall, but not limited to, all approved project submittals and vendor data.

PART 2 - PRODUCTS

2.1 CONTENTS

- A. The equipment manufacturers' operations and maintenance data shall contain, as a minimum, the following information as applicable:

- (a) Front matter
- (b) Introduction
- (c) Preparation for use of equipment
- (d) Principles of operation
- (e) Operating instructions
- (f) Maintenance and servicing instructions
- (g) Parts list
- (h) Repair and overhaul instructions
- (i) Warranty documents

2.2 FRONT MATTER

The front matter consists of a cover or title page, table of contents, and safety precautions.

- A. COVER. - The cover shall include the following identification: "OPERATIONS AND MAINTENANCE MANUAL", and include the name of the equipment, system, or facility component, the name of the Contractor, contract number, and date the manual was prepared.
- B. TITLE PAGE. - The title page shall contain the same information as the cover, and the following additional information: Names, addresses, phone numbers, and principal contact for each contractor and subcontractor installing the equipment, and the equipment manufacturer's local representative for each item of equipment.
- C. TABLE OF CONTENTS. - The manual shall contain a table of contents. The table shall list all parts, chapters, sections, and paragraph numbers in the order of presentation used in the text. It shall include a list of illustrations and a list of tables, whenever they are included in the manual.

- D. SAFETY PRECAUTIONS. - The manual shall contain safety precautions where hazards may be present during installation, operation, or maintenance of the equipment. Hazards may include, but are not limited to; presence of high voltage, electrostatic discharge, radio frequency radiation, radioactive materials, the presence of poisonous fumes or explosive gases, and the depletion of oxygen in a closed environment. During preparation of the narrative for equipment installation, operation, or maintenance; a hazard warning or caution statement shall precede the point in the narrative where the hazard may be encountered.

2.3 INTRODUCTION

The manual shall contain an introduction containing the following:

- (a) Purpose and functions of equipment.
- (b) Capabilities.
- (c) Performance characteristics.
- (d) Description; including model number, dimensions, weight, volume, and center of gravity, when applicable.
- (e) Power and utility requirements.
- (f) Environmental limitations.
- (g) List of items furnished with equipment.
- (h) List of additional items required for operation and maintenance, but not supplied with equipment.
- (i) Handling precautions and special storage requirements.
- (j) Warranty information.

2.4 INSTALLATIONS AND PREPARATION FOR USE INSTRUCTIONS

(NOT USED)

2.5 PRINCIPLES OF OPERATION

(NOT USED)

2.6 OPERATING INSTRUCTIONS

(NOT USED)

2.7 MAINTENANCE AND SERVICING INSTRUCTIONS

Maintenance and servicing instructions shall be provided for both preventive and corrective maintenance. Instructions shall include a list of test equipment, special tools, and materials needed for maintenance and service. This list shall include nomenclature, part/model number, application, range, and accuracy. Instructions should include illustrations to show how test connections are made. Actions and normal indications shall be shown for each test.

- A. Cleaning and inspection. - Periodic cleaning and lubrication information including types of cleaning agents and lubrication, and the frequency of lubrication and inspection intervals shall be included. Cleaning required during repair and shall be included in those appropriate sections.

- B. Performance verification. - (NOT USED)

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- C. Inspection. - Instructions for inspection of equipment and frequency of inspection for damage and wear shall be provided with emphasis on allowable service limits such as wear, backlash, end play, balance, voltage, resistance, pressure, and/or length and depth of scoring.
- D. Troubleshooting. - Equipment malfunctions that may occur during operation shall be identified. Equipment troubleshooting data and fault isolation techniques shall include:
- (a) An indication or symptom of trouble.
 - (b) The instructions necessary, including test setups, to determine the cause of the problem.
 - (c) The action required restoring the roof.

The troubleshooting information shall be in a chart, logic tree, or tabular format with appropriate headings, or as a logic, block, or schematic diagram. Troubleshooting data shall include instructions suitable for identifying the lowest replaceable unit (LRU) that when removed and replaced will restore the equipment to operation.

- E. Disassembly, repair, replacement, and reassembly. - (NOT USED)
- F. Reprogramming. - (NOT USED)
- G. Preparation for shipment. - (NOT USED)

2.8 PARTS LIST

The manual shall include a parts list containing positive identification of parts in the equipment item.

- A. Illustrated parts list. - Clear and legible illustrations shall identify component parts and parts relationship.
- B. Parts listing. - Part names and part numbers shall be shown on illustrations or tables. When the illustrations do not contain both part numbers and part names, the illustrations and the separate listing shall show either index reference, or key-numbers that cross-reference from the illustrated parts to a parts list. The parts list shall identify the actual manufacturer/vendor and the part number or generic description. Parts in the listing shall be grouped by assemblies, subassemblies, and modules with the parts identified to the assembly from which they are components.
- C. Common commercial parts. - Common commercial hardware and items that are not of special design such as bolts, washers, nuts, screws, fittings, keys, hinges, wire, cable, gasket material, tubing, and hose that are available from a wide range of sources shall be identified by part number or the notation "Commercial" instead of a part number. The part name including nomenclature or description shall be complete enough to facilitate substitution of equivalent items as shown below:

Examples:

<u>Figure No.</u>	<u>Part No.</u>	<u>Part Name (Nomenclature or Description)</u>
2-4	Commercial	Nut, hex head, plain steel, 1/4"-20 UNC-3BS
2-5	Commercial	Wire, electrical, copper tin plated, No. 14 AWG. 19 strands of No. 27 AWG, 0.250 in. dia.

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- D. Recommended spare parts. - The equipment manufacturer or supplier shall provide a list of recommended spare parts that are required to support the operational use of the equipment for a one year time period. Recommended spare parts that are not "off the shelf" and have a delivery lead time greater than one month from receipt of order shall be so noted.

2.9 OPERATIONAL AND MAINTENANCE ILLUSTRATIONS

Manuals shall contain illustrations for locating and identifying all components significant to operations and maintenance. Line drawings, photographs or halftones shall show the configuration and parts relationship to aid in removal and disassembly procedures. Free hand sketches shall not be acceptable. Where appropriate, the manual shall contain the following diagrams:

- (a) Simplified functional block
- (b) Locator
- (c) Piping
- (d) Hydraulic
- (e) Schematic
- (f) Flow Control
- (g) Electrical
- (h) Process Flow
- (i) Instrumentation

Symbols used on illustrations or diagrams shall be ANSI standards or common to the trade or industry. Where nonstandard symbols are used, explanations shall be provided.

2.10 OVERHAUL INSTRUCTIONS
(NOT USED)

2.11 EQUIPMENT WARRANTIES

The O&M manuals shall contain warranty documents for all equipment items that are listed in the manual. The warranty shall specify the time that the warranty is in effect from final turnover by the Contractor to the COR. The warranty shall also include:

- (a) Equipment name and description as marked on the equipment nameplate.
- (b) Name, address, phone number, and name of principal contact of the manufacturer or supplier.
- (c) Local authorized service agency of the manufacturer or supplier including name, address, phone number, and principal contact.
- (d) Manufacturer's warranty statement that specifies the scope of warranty coverage.
- (e) The manufacturer's specified method or procedure for obtaining warranty service.
- (f) Supplemental information regarding factors that might invalidate the warranty.

PART 3 – EXECUTION (NOT USED)

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END OF SECTION 01720

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SECTION 01730 - OSHA SAFETY REQUIREMENTS

PART 1 – GENERAL

1.1 SCOPE

- A. This section identifies some of the requirements of the OSHA Construction Standard.
- B. Formulation of a site specific safety plan

1.2 CONTRACTOR RESPONSIBILITY

- A. General Safety Provisions - The Contractor shall bear full responsibility to provide safe working conditions for its employees and Contractors. The Contractor shall not permit any employee or Subcontractor to work in surroundings or under working conditions that are unsanitary, hazardous, or dangerous to the health and safety of the employee.
- B. Accident Prevention - The Contractor shall bear the responsibility of maintaining an accident prevention program such that frequent and regular inspections of the job site, materials and equipment are made by a competent person designated by the employer.
- C. Use of Equipment - The Contractor shall not permit the use of any machinery, tool, material, or equipment that is not in compliance with OSHA regulations. The employer shall permit only those employees qualified by training and/or experience to operate equipment and machinery.

1.3 SUBMITTALS

- A. Submittals required include, but are not necessarily limited to, the following:
 - 1. Contractor Safety Plan

1.4 CONTRACTOR RESPONSIBILITY

- A. The FAA shall not be held responsible for safety inspections to assure Contractor conformance with the OSHA safety regulations. The FAA, however, reserves the right to notify the Contractor of any deficiencies regarding worker safety.
- B. The FAA will evaluate the Contractor on its safety performance, including that of its Subcontractors. The number and severity of safety and security violations will be considered in this evaluation. Contractor safety violations are cause for termination for default, may result in notification of the Contractor's bonding company, and will affect the Contractor's opportunity to propose on future work. Failure to correct such deficiencies may impact the Contractor's ability to work on future FAA contracts.

1.5 OSHA REGULATIONS

- A. The Contractor shall comply with the latest Occupational Safety and Health Administration regulations (CFR 29 Part 1926) regarding safety in the work area.

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- B. The Contractor shall be responsible for obtaining copies of non-FAA referenced documents without additional cost to the FAA. If Contractor requests a copy of FAA directives, they may be obtained by contacting the Contracting Officer.
- C. The Contractor is not relieved from adhering to other OSHA requirements not listed herein. The Contractor shall consult the latest referenced OSHA documents for safety regulations.
 - 1. Documents:
 - a) OSHA Documents:
 - 1) CFR 29 Part 1926 Safety and Health Regulations for Construction
 - 2) CFR 29 Part 1910 General Industry Standards Applicable to Construction Industry
 - b) FAA Documents:
 - 1) FAA Order 3900.49 Control of Hazardous Energy During Maintenance, Servicing and Repair

1.6 SAFETY PLAN

The contractor must develop and implement a site specific comprehensive Health and Safety Plan (HASP) based on the scope of work, for his or her employees as well as others in the area and the properties around. It shall cover all aspects of onsite construction operations and activities associated with the contract. This plan must comply with 29 CFR 1926, FAA Order 3900.19B, other applicable health and safety regulations and any project-specific requirements. The contractor must provide the Contracting Officer with a copy of this plan. Acceptance of the contractor's HASP only signifies that the plan generally conforms to the requirements of the contract. It does not relieve the contractor of the responsibility for providing with a safe and healthful work environment. At a minimum the HASP shall address the following:

- A. Workplace address
- B. Name and address of the principal contractor
- C. Key Personnel, phone nos and addresses
- D. Estimated duration of the work
- E. Hazard assessment and identification of the hazards in the scope of work
- F. Mitigation of hazards and proposed control measures for the risks
- G. Hazard Communication methods
- H. How the controls will be implemented
- I. Personal Protective Equipment

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- J. Training
- K. Severe weather plans: Hurricane and thunderstorms are the chief concerns for Miami.
- L. Medical Surveillance
- M. Exposure Monitoring and Air Sampling
- N. Site Control
- O. Emergency Response/Contingency Plan
- P. Emergency Action Plan
- Q. Confined Space Entry
- R. Spill Containment
- S. Documentation and Record Control
- T. Arrangements for monitoring and reviewing controls
- U. Lock-out and Tag-out

The plan must be written so it is easy to understand, signed and dated by the General Contractor. It must be available for the length of the project. The General Contractor cannot allow work to start unless the plan has been discussed with or a copy given to all relevant people and the plan is readily available for inspection. The plan must be amended if there are changes in how risks will be managed. The General Contractor must inform any affected person of the change.

PART 2 – MATERIAL

NOT USED

PART 3 – EXECUTION

3.1 CFR 29 PART 1926 - SAFETY AND HEALTH REGULATIONS FOR CONSTRUCTION

- A. This section contains a partial listing of the referenced OSHA standards. The Contractor is responsible for adhering to all applicable regulations including those not specifically referenced herein.
 - 1. Subpart D (Occupational Health and Environmental Controls) - Contractor shall furnish adequate supply of potable water in containers clearly marked as potable water. Containers containing non-potable water shall be clearly marked. Contractor shall furnish toilet facilities based on the number of employees present on the job-site. A minimum of 1 facility is required for less than 20 employees. See CFR 29 Part 1926 Subpart D for complete requirements.

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2. Subpart E (Personal Protective Equipment) - The Contractor shall provide adequate protection for the head, hearing, and eyes for all employees working in an area where hazards to the head, ear and eyes exist. See CFR 29 Part 1926 Subpart E for complete requirements.
3. Subpart I (Tools) - All hand tools and power tools and similar equipment whether furnished by the Contractor or the employee shall be maintained and operated in a safe condition. Personal protection shall be used when applicable. The use of tools shall be limited to the intended use of said tools. See CFR 29 Part 1926 Subpart I for complete requirements.
4. Subpart K (Electrical) - The Contractor shall furnish ground fault protection for all electrical equipment used on the jobsite. Extension cords shall be three wire ground in good shape. Installation of the facilities will require energizing numerous circuits. The Contractor shall protect against electrical shock by methods such as posting warning signs, supplying insulated gloves, locking out and tagging de-energized circuits, and other similar methods. See CFR 29 Part 1926 Subpart K for complete requirements.

**3.2 CFR 29 PART 1910 - GENERAL INDUSTRY STANDARDS APPLICABLE TO
CONSTRUCTION INDUSTRY**

- A. This section contains a partial listing of the referenced OSHA standards. The Contractor is responsible for adhering to all applicable regulations including those not specifically referenced herein.
 1. Section 1910.147 - Contractor shall maintain a written hazardous energy control procedure in accordance with CFR 29 1910.147. The written procedure shall describe contractor's responsibilities regarding shift changes or personnel changes. A specific coordinated lockout/tagout procedure shall be recorded in writing and signed by the Contractor and Contracting Officer with copies to each party.
 2. Section 1910.120 - The Contractor shall develop and implement an Emergency Response and Contingency Plan in accordance with OSHA Standard 29 CFR 1910.120. In the event of an emergency associated with remedial action, the Contractor shall, without delay, take diligent action to remove or otherwise minimize the cause of the emergency; alert the Contractor; and institute whatever measures might be necessary to prevent any repetition of the conditions of actions leading to, or resulting in, the emergency. Emergency contact names and telephone numbers shall be posted at all project phones and in site-support vehicles as well as included within the plan.

PART 4 – QUALITY ASSURANCE

NOT USED

*** END OF SECTION 01730 ***

SECTION 01731 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes procedural requirements for cutting and patching.
- B. Related Documents: Refer to Attachment "Eastern Service Area Guidance for Welding, Cutting and Brazing Activities" located behind this Section.
- C. Related Sections include the following:
 - 1. Divisions 2 through 16 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
 - a. Requirements in this Section apply to mechanical and electrical installations. Refer to Divisions 15 and 16 Sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

1.2 DEFINITIONS

- A. Cutting: Removal of existing construction necessary to permit installation or performance of other Work.
- B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.3 SUBMITTALS

- A. Cutting and Patching Proposal: Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:
 - 1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
 - 2. Changes to Existing Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
 - 3. Products: List products to be used and firms or entities that will perform the Work.
 - 4. Dates: Indicate when cutting and patching will be performed.
 - 5. Utilities: List utilities that cutting and patching procedures will disturb or affect. List utilities that will be relocated and those that will be temporarily out of service. Indicate how long service will be disrupted.
 - 6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.

7. Contracting Officer's Representative (COR) Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.4 QUALITY ASSURANCE

- A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
- B. Operational Elements: Do not cut and patch the following operating elements and related components in a manner that results in reducing their capacity to perform as intended or that result in increased maintenance or decreased operational life or safety.
 1. Primary operational systems and equipment.
 2. Air or smoke barriers.
 3. Fire-protection systems.
 4. Control systems.
 5. Communication systems.
 6. Conveying systems.
 7. Electrical wiring systems.
 8. Operating Systems of Special Construction in Division 13 Sections.
- C. Miscellaneous Elements: Do not cut and patch the following elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that result in increased maintenance or decreased operational life or safety.
 1. Water, moisture, or vapor barriers.
 2. Membranes and flashings.
 3. Exterior curtain-wall construction.
 4. Equipment supports.
 5. Piping, ductwork, vessels, and equipment.
 6. Noise- and vibration-control elements and systems.
- D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in COR's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
 1. If possible, retain original Installer or fabricator to cut and patch exposed Work listed below. If it is impossible to engage original Installer or fabricator, engage another recognized, experienced, and specialized firm.
- E. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.6 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections of these Specifications.
- B. Existing Materials: Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
 - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of existing materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
 - 1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
 - 2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Existing Services: Where existing services are required to be removed, relocated, or abandoned, bypass such services before cutting to avoid interruption of services to occupied areas.

3.3 PERFORMANCE

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut existing construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Cutting: Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 2. Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 3. Concrete: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 4. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 5. Proceed with patching after construction operations requiring cutting are complete.
- C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
 4. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.
 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

3.4 EXTERIOR DISTURBANCES

- A. Repair soil, grass and plantings which were disturbed to their pre-construction appearance.

END OF SECTION 01731



U.S. Department
of Transportation
**Federal Aviation
Administration**

Memorandum

Subject: **ACTION:** Safety Requirements for Welding,
Cutting, or Brazing Activities

Date: APR 01 2005

From: Director, Eastern Service Area for Technical
Operations

Reply to
Attn. of:

To: Manager, Engineering Services for Eastern
Service Area
All SMO/AOCC Managers, Eastern Service
Area

The Federal Aviation Administration (FAA) and contractor personnel perform welding, cutting, and/or brazing activities at FAA facilities. These activities have led to fires causing injury, property damage, and/or other indirect costs from project schedule extensions. The fire hazard associated with these activities is significantly increased due to the heat, sparks, and slag generated. Therefore, special precautions must be taken to prevent fires during welding, cutting, and/or brazing activities.

The Occupational Safety and Health Administration (OSHA) has promulgated specific regulations when conducting these welding, cutting, and brazing activities to prevent fires and other hazards such as eye damage from radiant light. These regulations are found in Title 29 Code of Federal Regulations (CFR) 1910, Subpart Q, *Welding, Cutting, and Brazing* and 29 CFR 1926, Subpart J, *Welding and Cutting*.

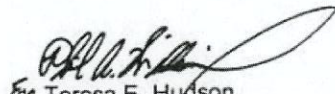
Attachment 1 summarizes the OSHA requirements for personnel who will perform or supervise any welding, cutting, or brazing activity conducted at an FAA facility. These requirements include fire watches, removal of combustibles or flammables from the area, and other precautions that must be followed for these activities. Failure to fully comply with these requirements could translate in injury, fatalities, property damage, and/or impact to the National Airspace System (NAS). The facility managers and resident engineers must ensure that FAA and contractor personnel follow the requirements outlined in the attachments while performing welding, cutting, or brazing activities.



U.S. Department
of Transportation
**Federal Aviation
Administration**

Memorandum

If you or your staff has any questions, please contact Steve Hardee, Atlanta Implementation Center, Environmental and Occupational Safety and Health (EOSH) Coordinator, at (404) 305-6479.


For Teresa E. Hudson

3 Attachments
Eastern Service Area Guide
Personal Protective Equipment Assessment
Work Permit

ATTACHMENT 1

EASTERN SERVICE AREA GUIDANCE FOR WELDING, CUTTING, AND BRAZING ACTIVITIES

BACKGROUND.

Welding processes require heat and other substances to produce the weld; therefore, the potential for fire or explosion and injuries resulting from arc radiation, electrical shock, or materials handling is increased. Byproducts of the welding, cutting, and brazing processes include fumes and gases that can pose serious health hazards to employees. These activities exclude soldering. Minimizing the hazards associated with welding, cutting, and brazing is necessary to provide a safe work environment. Achievement of this goal begins with the implementation of the requirements in this guidance document.

FIRE PREVENTION REQUIREMENTS.

In order to prevent fires during welding, cutting, and brazing activities the following precautionary activities must be performed:

- Before welding, cutting, or brazing work is permitted, the area must be made fire safe and the individual(s) responsible for the operation must inspect the work area.
- All movable combustible and/or flammable materials must be transported at least 35 feet from all welding or burning activities.
- If the object to be welded or cut cannot be moved, and if all fire hazards cannot be removed, then barriers or fire blankets must be used to isolate the combustible materials from the heat, sparks, and slag.
 - ◊ All fire blankets shall be free of holes, rips and tears, and cover the entire combustible material that is within the proposed welding work area.
- All cracks and openings through which hot sparks or slag could enter must be sealed or a fire resistant shield must be used to block the openings.
- Operational fire extinguishing equipment must be maintained in a state of readiness for instant use/within 20 feet.
- A fire watch with an approved portable fire extinguisher, not one that is currently provided for the facility, must be established to ensure the safety of the workers and the protection of assets.
 - ◊ The work area should be observed for no less than 30 minutes (60 minutes for roof work) after the completion of the work and must be specified on the hot work permit.
- Fire detection equipment in vicinity of welding, cutting, and brazing operation should be protected from false activation and damage. Fire suppression systems should be protected by noncombustible shielding or guarding to prevent inadvertent activation.
- Ensure an anti-flashback device is used on acetylene and oxygen tanks. Ensure all compressed gas cylinders are in good working condition and are properly stored and used in accordance with OSHA standard 1910.101, *Compressed Gases*.

SAFE WORK PRACTICES.

A safe work environment is not enough to control all hazards associated with welding, cutting, and brazing. The following safe work practices must be followed to prevent fire or injury.

- If conducting welding, cutting, or brazing activities, perform a risk evaluation and address any other potential ancillary hazards. Some examples of potential ancillary hazards include, but not limited to, welding, cutting, and brazing:
 - ◊ On substrates with lead based paint or on galvanized metals (zinc fumes),
 - ◊ In areas that impacts the egress paths (e.g. stairwells); or
 - ◊ That requires respirator use.
- All persons involved in welding, cutting, and brazing operations shall:
 - ◊ Use safe work practices and engineering controls to protect persons in adjacent areas and FAA property; and
 - ◊ Wear the appropriate Personal Protective Equipment (PPE) as listed in the PPE Hazard Assessment contained in Attachment 2.
- The location of hot work should be determined using the following priority list:
 - ◊ The work should be performed in an area designed for hot work use such as welding shops.
 - ◊ If work must be performed on site, combustibles should not be located within 35 feet of the work area.
 - ◊ If work must be performed on site and combustibles cannot be removed from within 35 feet of the work area, fire barriers such as screens or blankets will be used to protect combustibles.
- Only authorized and trained personnel are permitted to use welding, cutting, or brazing equipment.
- Welding screens must be provided in areas where pedestrian traffic may be exposed to flashes or sparks.
- In the area where the welding, cutting, and brazing activities are occurring, ensure adequate ventilation is available.
- Welding, cutting, brazing, or grinding on vessels, tanks, drums, or other containers that contain or have contained flammable materials is prohibited, unless approved by the Service Area Safety Staff.
- Use of chlorinated hydrocarbons (e.g. solvents, degreasers, etc.) for cleaning substrates prior to welding is prohibited due to the toxic gases that may form.
- Do not observe welding, cutting, and brazing activities without the proper PPE.
- Routine grinding is not considered hot work; however, any grinding on piping, containers, or other vessels that contain or have contained flammable materials is considered hot work and a hot work permit is required.

HOT WORK PERMIT REQUIREMENTS.

Hot work includes, but is not limited to; electrical/gas welding, torch cutting, brazing, any activity that produces open flames, and grinding on containers/vessels that contain or have contained flammable materials. A hot work permit (Attachment 3) is required for any operation involving open flames or producing heat and/or sparks or when welding, cutting, or brazing activities are performed in a confined space.

The person responsible for the facility must approve any hot work permits. Contractors' performing hot work must complete the FAA Hot Work Permit or their own equivalent permit and this permit must be approved by the project Resident Engineer (RE). The RE must coordinate all project-related hot work with the manager of the facility. If the required precautions cannot be met, hot work is prohibited.

- Before any welding, cutting, or brazing work begins, a hot work permit must be completed and approved.
- All hazards and precautions noted on the permit must be addressed before operations begin.

- The permit must be prominently posted in the area, where the hot work is performed.
- Upon completion of hot work operations, maintain the permit in the project file or as needed.

PERSONAL PROTECTIVE EQUIPMENT (PPE) REQUIREMENTS.

When welding, cutting, and brazing hazards exist that cannot be eliminated, engineering controls, administrative procedures, safe work practices, PPE, and proper training for welding will be implemented. These measures will be implemented to minimize those hazards to ensure the safety of employees and the public.

Employee protection during welding operations must include all requirements as shown in the attached PPE Hazard Assessment for welding, cutting, and brazing activities.

- The work supervisor shall provide employees with the appropriate PPE as needed and shall ensure that the equipment is used properly.

TRAINING.

Employees and contractors who perform welding, cutting, and brazing operations in FAA facilities must be trained to:

- Recognize the hazards associated with various welding operations,
- Know the safe work practices for welding, cutting, and brazing operations;
- Understand the importance and requirements of hot work permits and fire prevention,
- Use the appropriate PPE for the job; and
- Understand the importance of regular inspections of welding equipment, attachments, and accessories.

ATTACHMENT 2

**Federal Aviation Administration
Personal Protective Equipment Hazard Assessment**

Job Task Welding, Cutting, or Brazing

Task #: 8

	ASSESSMENT OF HAZARD	PPE REQUIRED	CORRECTIVE ACTION	RAC *
HEAD				
EYES OR FACE	Ultraviolet (UV) light, sparks, and debris, during welding cutting, or brazing	Welding helmet or goggles with appropriate UV protection	Don appropriate PPE	4
SKIN	Burns from welding	Welders jacket/smock and covering for legs	Don appropriate PPE, have fire extinguisher nearby	4
HAND	Burns, cuts, and scrapes	Leather welding gloves	Don appropriate PPE	5
FOOT	Burns from welding, cutting, or brazing	Spats	Don appropriate PPE	5
HEARING				
ELECTRICAL SHOCK	Ground fault of welding cable	Rubber mats when working in wet areas	Use clean dry rubber mats, do not splice cable within six feet of welder or equipment	5
WHOLE BODY				
RESPIRATORY	Welding fumes	See corrective action	Weld in open well-ventilated areas, avoid inhalation of welding fumes.	5

NOTE:

- Be aware of the potential for heat stress when wearing arm and leg coverings.
- Prior to performing welding, cutting, and brazing activities conduct a risk evaluation to determine what respiratory hazards are present.
- Workers in area of welding, cutting, and brazing operations must not watch welding unless wearing appropriate PPE.

*** Risk Assessment Code (RAC)**

RAC 1 = Likely to occur immediately/current condition and cause serious injury or death; RAC 2 = Probably will occur in time and cause serious injury.
RAC 3 = Possible to occur in time and cause a lost workdays; RAC 4 = Possible to occur in time and cause minor injury treatable with first aid; RAC 5 = Unlikely to occur and cause minor injury.

These job tasks and PPE are based on general hazards that are encountered during these tasks. However, the facility supervisor has the authority and responsibility of changing the PPE if the hazards change or become more severe. Each facility supervisor also should ensure that all technicians are wearing the PPE as necessary for each task.

CONSTRUCT HAZARDOUS MATERIALS STORAGE BUILDING
MIAMI AIR ROUTE TRAFFIC CONTROL CENTER (ARTCC)

14 JUNE, 2010
FAA-ZMA-900814

ATTACHMENT 3

HOT WORK PERMIT
(for welding, cutting, or brazing activities)

THIS FORM MUST BE COMPLETED IN ITS ENTIRETY BY THE RESPONSIBLE PERSON PERFORMING THE HOT WORK,
OR THE RESIDENT ENGINEER OVERSEEING THE CONTRACTOR WHO IS PERFORMING THE HOT WORK.

Facility ID and Type: _____ Date: _____
Responsible Person: _____ Start Time: _____
Work to be performed: _____ Finish Time: _____
Building: _____
Room Number, Area or Equipment: _____

Is it possible to perform this work in a welding shop or other type of workshop? Yes No

Complete the checklist below and if any of the tasks have not been completed, please provide, in the comments section the reasons for not completing the tasks and the precautionary measures that will be implemented.

Task	Yes	No	Comments and/or Corrective Measures
Flame or spark-producing equipment to be used has been inspected and found in good repair.			
Fire Alarm systems are operational and will not be taken out of service while welding, cutting, or brazing activities are performed. If necessary, the automatic smoke detectors in the immediate vicinity of the hot work may be temporarily disabled via functions at the fire alarm control panel or otherwise covered, and returned to operational immediately following the smoke producing activities associated with the hot work.			
Sprinklers, where provided, are operational and will not be taken out of service while this work is being done.			
There are no combustible fibers, dusts, vapors, gases or liquids in the area.			
The work will only be performed in the area specified on this permit.			
Surrounding floors have been swept clean and, if combustible, wet down.			
All floor and wall openings within 35 feet of the operations have been tightly covered.			
All combustibles have been relocated at least 35 feet from the operation. If no, then are barriers or guards used to contain the heat, sparks and slag. Protection should include metal guards or flame-proofed curtains, blankets, or covers (not ordinary tarpaulins (tarps)).			

Guidance for Welding, Cutting and Brazing Activities
Attachment 3

CONSTRUCT HAZARDOUS MATERIALS STORAGE BUILDING
MIAMI AIR ROUTE TRAFFIC CONTROL CENTER (ARTCC)

14 JUNE, 2010
FAA-ZMA-900814

Task	Yes	No	Comments and/or Corrective Measures
A "Fire Watch" will be posted in area of activity, prior to starting welding, cutting, and brazing activity, and will patrol the area, including floors above and below, during any lunch or rest period and for at least one-half hour after the work has been completed to ensure the sparks and slag have not started fires.			
If bystanders and/or fire watch may be exposed to UV or burn hazards they will be appropriately protected with PPE.			
Fire extinguisher available for instant use within 20 feet.			
Cutter/welder is trained in safe operation of equipment and the safe use of the process.			
On-site contractors were advised about flammable material or hazardous conditions of which they may not be aware.			
Welding or cutting on material containers that contain or did contain flammables: Container thoroughly cleaned and ventilated; Any pipe lines or connections to containers disconnected or blanked; and Approved by ROSHM or EOSH Coordinator.			
Personal Protective Equipment (PPE) used: Eye protection Helmets Protective clothing Other (Specify)			
Warning sign posted to warn of hot metal.			
Appropriate ventilation provided.			
When working in confined spaces a permit has been issued as per 1910.146 and local Confined Space Program.			

For specific requirements refer to General Industry Standards 1910.146; 1910.252; .253; .254 and .272 and Construction Standards 1926.803; .350; .352 and .353.

I attest that the above precautions have been taken:

Printed Name of Person Responsible
for Performing Hot Work

Signature

Approval:

Facility Manager - Printed Name

Facility Manager - Signature

NOTE: THIS PERMIT EXPIRES 24 HOURS AFTER THE DESIGNATED "START TIME". IF WORK IS TO CONTINUE ANOTHER PERMIT MUST BE ISSUED.

MAINTAIN THE COMPLETED AND APPROVED PERMITS ON FILE FOR A MINIMUM OF ONE YEAR.

Guidance for Welding, Cutting and Brazing Activities
Attachment 3

CONSTRUCT HAZARDOUS MATERIALS STORAGE BUILDING JUNE 14, 2010
MIAMI AIR ROUTE TRAFFIC CONTROL CENTER (ARTCC) FAA-ZMA-900814

SECTION 01800 CONTRACT CLOSE OUT

PART 1 - GENERAL

1.1 SUMMARY

The contractor shall require each subcontractor engaged upon the work to bear full responsibility for cleaning up during and immediately upon completion of his work. All rubbish, waste, tools, equipment and other apparatus caused by or used in the execution of his work shall be removed. This shall in no way be construed to relieve the contractor of his primary responsibility for maintaining the building and the site clean and free of debris, and leaving all work in a clean and proper condition acceptable to the COR. All exposed floor surfaces shall be protected against all mechanical damage, mortar or plaster droppings, oil, grease, or other damage that will stain or soil the finish. Protection shall be maintained until all work has been completed.

- A. Rubbish removal. - Immediately after unpacking, all packing material, case lumber, wrappings, or other rubbish, flammable or otherwise, shall be collected and removed from the building and the premises.
- B. Overall cleaning. - Immediately before the final inspection, the entire exterior and interior of the building and the surrounding areas shall be thoroughly cleaned by the contractor, including but not limited to the following:
 - 1. All construction facilities, debris and rubbish shall be removed from the building and the site.
 - 2. All finished surfaces disturbed by this construction shall be swept, dusted, vacuumed, washed or polished as required.
 - 3. All tools, scaffolding, temporary utility connections or buildings, belonging to the contractor or used under his direction shall be removed from the site.

1.2 PROJECT RECORD DOCUMENTS

- A. Maintenance of documents. - The following documents shall be maintained at the project site:
 - 1. Contract drawings
 - 2. Contract specifications
 - 3. Addenda
 - 4. Reviewed shop drawings
 - 5. Change orders
 - 6. Field test reports
 - 7. Project correspondence
 - 8. Software information specific to this project
 - 9. Other modifications to contract
- B. Storage and use of documents. - Store record documents apart from documents used for construction; do not use record documents for construction purposes. Keep documents in clean, dry, legible condition; provide file cabinets and racks for storage of drawings.
- C. Marking devices. - Use red colored pencil for all marking.

CONSTRUCT HAZARDOUS MATERIALS STORAGE BUILDING JUNE 14, 2010
MIAMI AIR ROUTE TRAFFIC CONTROL CENTER (ARTCC) FAA-ZMA-900814

- D. Recording and labeling. - Label each document "Project Record" in 1-inch high printed block letters. Keep record documents current. Do not conceal or cover up any item of work until the information has been recorded.
- E. Submittals. - At completion of project, deliver record documents to COR. Accompany submittal with transmittal letter containing the following:
 - 1. Date
 - 2. Project title and number
 - 3. Contractor's name and address.
 - 4. Title and number of each record document
 - 5. Certification that each document as submitted is complete and accurate.
 - 6. Signature of contractor, or his authorized representative

1.3 CONTRACT DOCUMENTS

- A. Contract drawings. - Legibly mark to record actual construction:
 - 1. Horizontal and vertical location of underground and overhead utilities and appurtenances referenced to permanent surface improvements.
 - 2. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.
 - 3. Field changes of dimension and detail.
 - 4. Changes made by change order or field order.
 - 5. Details not on originally specified drawings.
- B. Contractor specifications and addenda. - Legibly mark each section to record:
 - 1. Manufacturer, trade name, catalog number, and supplier of each item of equipment actually installed.
 - 2. Changes made by change order or field order.
 - 3. Other matters not originally specified.
- C. Shop drawings. - Shop drawings shall be maintained as record documents; legibly annotate drawings to record changes made after review.

1.4 COMPLETION CERTIFICATE

When the contractor considers the work complete, the contractor shall submit written certification that contract documents have been reviewed; work has been inspected for compliance with contract; equipment and systems have been tested in the presence of the RE and are operational. Second, the contractor also certifies that the required operational, and maintenance manuals, data, and parts list have been submitted and approved; spare parts have been provided as required; required instruction of maintenance personnel has been accomplished; work is completed, premises cleaned and ready for inspection; and the warranty certificates from all new equipment manufacturers have been provided.

1.5 FINAL INSPECTION

A written request for a final inspection shall be sent to the Resident Engineer fourteen (14) calendar days prior to the requested inspection date. The final inspection shall be scheduled at a mutually agreed upon date, and will be acknowledged by the Resident Engineer. The contractor shall develop his own pre-final inspection and correct all deficiencies prior to requesting the final inspection. The pre-final report shall accompany the final inspection request.

If, during the final inspection, the Resident Engineer, in concurrence with the inspection team and the Contracting Officer, determines that the contractor was not ready for the final inspection, based on the contractor not meeting all of the contractual requirements, all costs incurred by the Government for additional inspections shall be deducted from the contract (including but not limited to: travel cost, per diem, salaries of all concerned parties, consultant engineer personnel, and FAA personnel required to participate in the final inspection). This dollar amount shall be the actual cost incurred by the FAA to perform the final inspection.

1.6 PUNCH LIST

During the final inspection, the Resident Engineer, in coordination with the regional office and local FAA personnel shall develop a list (Punch List) of all deficiencies (unsatisfactory work, latent or patent defects, etc.). A copy of the punch list will be furnished to the contractor as a draft list after the final inspection, while the original copy will be forwarded to the Contracting Officer. The inspection team shall generate only one official punch list.

The Contracting Officer will furnish to the contractor the official punch list within fourteen calendar days after completion of the final inspection. The contractor shall be allowed 30 calendar days to correct all deficiencies noted.

1.7 ACCEPTANCE OF WORK

The contractor shall correct discrepancies noted during the final inspection, clean the premises, and notify the Resident Engineer that the work is ready for acceptance. The Resident Engineer shall verify that the official punch list has been accomplished and initialize and date each item as it is completed.

END OF SECTION 01800

* * * * *

SECTION 02300 - EARTH MOVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Preparing sub-grades for slabs-on-grade
2. Excavating and backfilling for buildings and structures.
3. Drainage course for concrete slabs-on-grade.
4. Sub-base course and base course for asphalt paving.
5. Excavating and backfilling for utility trenches.

1.2 DEFINITIONS

A. Backfill: Soil material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the sub-base course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated sub-grade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above sub-grade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below sub-grade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Unauthorized Excavation: Excavation below sub-grade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

- H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- I. Sub-base Course: Aggregate layer placed between the sub-grade and base course for hot-mix asphalt pavement, or aggregate layer placed between the sub-grade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
- J. Sub-grade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below sub-base, drainage fill, drainage course, or topsoil materials.
- K. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.3 QUALITY ASSURANCE

- A. Pre-excavation Conference: Conduct conference at Project site.

1.4 PROJECT CONDITIONS

- A. Utility Location: Coordinate with Resident Engineer and verify underground utilities with in project area before beginning earth moving operations.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. Sub-base Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- B. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.
- C. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.
- D. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

2.2 ACCESSORIES

- A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick continuously inscribed with a description of the utility; colored to comply with local practice or requirements of the Resident Engineer
- B. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches) wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored to comply with local practice or requirements of the Resident Engineer

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.
- B. Protect and maintain erosion and sedimentation controls during earth moving operations.

3.2 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavate to sub-grade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
 - 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
 - 2. Saw cut all pavement prior to removal for excavation

3.3 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
 - 1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

3.4 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
- B. Excavate trenches to uniform widths to provide the following clearance on each side of wire or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of wire or conduit unless otherwise indicated.
 - 1. Clearance: 6 inches each side of wire or conduit.
- C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of wire and conduit. Shape sub grade to provide continuous support for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench sub grade.

3.5 SUBGRADE INSPECTION

- A. Proof-roll sub-grade below the building slab with a pneumatic-tired dump truck to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated sub-grades.
- B. Reconstruct sub-grades damaged by, rain, accumulated water, or construction activities, as directed by the Resident Engineer, without additional compensation.

3.6 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by the Resident Engineer.
 - 1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

3.7 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 1. Stockpile soil materials away from edge of excavations.

3.8 UTILITY TRENCH BACKFILL

- A. Place backfill on sub-grades free of mud.
- B. Place and compact initial backfill of sub-base material, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the wire or conduit.
- C. Place and compact final backfill of satisfactory soil to final sub-grade elevation.

- D. Install warning tape directly above utilities, 6 inches below finished grade,

3.9 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
 - 1. Under building slabs, use engineered fill.

3.10 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate sub-grade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
 - 1. Do not place backfill or fill soil material on surfaces that are
 - 2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.11 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698.
 - 1. Under structures, building slabs, steps, and pavements, scarify and re-compact top 12 inches of existing sub-grade and each layer of backfill or fill soil material at 95 percent.
 - 2. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent.

3.12 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
- B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish sub-grades to required elevations within the following tolerances:
 - 1. Pavements: Plus or minus 1/2 inch.

3.13 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

- A. Place sub-base course and base course on sub-grades free of mud.
- B. On prepared sub-grade, place sub-base course and base course under pavements and walks as follows:
 - 1. Shape sub-base course and base course to required crown elevations and cross-slope grades.
 - 2. Place sub-base course and base course with no compacted layer more than 6 inches thick or less than 3 inches thick.
 - 3. Compact sub-base course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698

3.14 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

- A. Place drainage course on sub-grades free of mud.
- B. On prepared sub-grade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
 - 1. Place drainage course in a compacted layer of 4 inches
 - 2. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.15 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.
- B. Allow testing agency to inspect and test sub-grades. Proceed with subsequent work only after test results for previously completed work comply with requirements.
- C. Footing Sub-grade: At footing sub-grades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing sub-grades may be based on a visual comparison of sub-grade with tested sub-grade when approved by Resident Engineer.
- D. When testing agency reports that sub-grades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; re-compact and retest until specified compaction is obtained.

3.16 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

- B. Repair and reestablish grades to the specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.17 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 02300

SECTION 02741 - HOT-MIX ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Florida Department of Transportation Standard Specification for Roads and Bridge Construction

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Hot-mix asphalt paving.
- B. Related Sections include the following:
01731 Cutting and patching

1.3 DEFINITIONS

- A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.
- B. FLDOT: Florida Department of Transportation.
- C. AI: Asphalt Institute

1.4 SYSTEM DESCRIPTION

- A. Provide hot-mix asphalt paving according to materials, workmanship, and other applicable requirements of standard specifications of FLDOT.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties of the following:
 - 1. Stone Matrix Asphalt, IM-19.0A
 - 2. Stone Matrix Asphalt, SM-9.0A
- B. Job-Mix Designs: Certification as approved by FLDOT for each job mix proposed for the Work.
 - 1. Surface Course: SM-9.0 A with PG-64-22 and an Aggregate Nominal Maximum Size of 3/8"
 - 2. Binder Course: IM-19.0 A with PG-64-22 and an Aggregate Nominal Maximum Size of 3/4"
- C. Qualification Data: For manufacturer.
- D. Material Test Reports: For each paving material.
- E. Material Certificates: For each paving material, signed by manufacturers.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer.
 - 1. Manufacturer shall be a paving-mix manufacturer registered with and approved by authorities of FLDOT.
- B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated, as documented according to ASTM E 548.
- C. Regulatory Requirements: Comply with Standard Specifications of FLDOT for asphalt paving work.
- D. Asphalt-Paving Publication: Comply with AI MS-22, "Construction of Hot Mix Asphalt Pavements," unless more stringent requirements are indicated.
- E. Preconstruction Conference: Conduct Pre-Construction conference at Project site to comply with requirements in Division 1. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:

1. Coordination of time and phasing of work locations.
2. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
4. Review condition of sub-grade and preparatory work.
5. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.
6. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. All excess excavated material shall become the property of the contractor and be removed from the project.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp or if the following conditions are not met:
 1. Tack Coats: Minimum surface temperature of 60 deg F.
 2. Asphalt Intermediate Course: Minimum surface temperature of 60 deg F at time of placement.
 3. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement..

PART 2 - PRODUCTS

2.1 ASPHALT MATERIALS

- A. Asphalt Binder: AASHTO MP 1, [PG 64-22].
- B. Tack Coat: ASTM D 977 emulsified asphalt or ASTM D 2397 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.

1. Apply to vertical surfaces of curbs, gutters, cold pavement joints, and structures in the pavement that will be in contact with hot-mix asphalt. Tack coat is also applied to existing pavement surfaces to bond new hot-mix asphalt paving overlays.

2.3 MIXES

- A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes approved by COTR and complying with the following requirements:

1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
 2. Intermediate Course: Stone Matrix Asphalt IM-19.0A
 3. Surface Course: Stone Matrix Asphalt SM-9.0A
- B. Emulsified-Asphalt Slurry: ASTM D 3910, Type 1 consisting of emulsified asphalt, fine aggregate and mineral fillers.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that sub-grade is dry and in suitable condition to support paving and imposed loads.
- B. Proceed with paving only after unsatisfactory conditions have been corrected.

3.2 REPAIRS

- A. Pavement cuts shall be wide enough to accommodate the compaction equipment
- B. Sub-grade will be compacted to 95% maximum dry density

3.4 SURFACE PREPARATION

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
 1. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.
- B. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.
 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.5 HOT-MIX ASPHALT PLACING

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
 - 1. Place hot-mix asphalt surface course in single lift.
 - 2. Spread mix at minimum temperature of 250 deg F and a minimum base temperature of 40 deg F.
 - 3. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes, unless otherwise indicated.
 - 4. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- B. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.6 JOINTS

- A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of hot-mix asphalt course.
 - 1. Clean contact surfaces and apply tack coat to joints.
 - 2. Offset longitudinal joints, in successive courses, a minimum of 6 inches (150 mm).
 - 3. Offset transverse joints, in successive courses, a minimum of 24 inches (600mm).
 - 4. Construct transverse joints as described in AI MS-22, "Construction of Hot Mix Asphalt Pavements."
 - 5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
 - 6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.7 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.
 - 1. Complete compaction before mix temperature cools to 185 deg F.

- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
 - 1. Average Density: 96 percent of reference laboratory density according to AASHTO T 245, but not less than 94 percent nor greater than 100 percent.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
- F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified to density and surface smoothness.
- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

3.8 INSTALLATION TOLERANCES

- A. Thickness: Compact each course to produce the thickness indicated within the following tolerances:

Retain thickness tolerances below or revise to suit Project.

- 1. Intermediate Course: Plus 1/4 inch (6 mm), no minus.
 - 2. Surface Course: Plus 1/4 inch (6 mm), no minus.
- B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot (3-m) straightedge applied transversely or longitudinally to paved areas:
 - 1. Intermediate Course: 1/2 inch
 - 2. Surface Course: 1/8 inch
 - 3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

3.9 DISPOSAL

A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.

1. Do not allow excavated materials to accumulate on-site.

END OF SECTION

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:

- 1. Slabs-on-grade

- B. Related Sections:

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Design Mixtures for Credit ID 1.1: For each concrete mixture containing fly ash as a replacement for portland cement or other portland cement replacements, and for equivalent concrete mixtures that do not contain portland cement replacements.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, length, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

- D. Qualification Data: For
 - 1. Testing Labs: Shall be accredited for construction material testing. Labs will Need to be accredited by one of the following agencies.
 - a. AASHTO Accreditation Program
 - b. National Voluntary Laboratory Accreditation Program
 - c. American Association for Laboratory Accreditation
 - d. Construction Materials Engineering Counsel
- E. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Steel reinforcement and accessories.
 - 4. Fiber reinforcement.
 - 5. Curing compounds.
 - 6. Joint-filler strips.
- F. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
 - 1. Aggregates.
- G. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

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- C. Testing Agency Qualifications: An independent agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
 - 2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.
- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

- A. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- B. Chamfer Strips: Wood, metal, PVC, or rubber strips, 1 by 1 inch, minimum.
- C. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

2.3 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.4 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 - 1. Portland Cement: ASTM C 150, Type I
 - a. Fly Ash: ASTM C 618, [Class F] [Class F or C].
 - b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or.
- B. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source
 - 1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Water: ASTM C 94/C 94M and potable.

2.5 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 - 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M,

2.6 VAPOR RETARDERS

- A. Sheet Vapor Retarder: Polyethylene sheet, ASTM D 4397, not less than 6 mils thick.

2.7 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
- a. Axim Italcementi Group, Inc.; CATEXOL CimFilm.
 - b. BASF Construction Chemicals - Building Systems; Confilm.
 - c. ChemMasters; SprayFilm.
 - d. Conspec by Dayton Superior; Aquafilm.
 - e. Dayton Superior Corporation; Sure Film (J-74).
 - f. Edoco by Dayton Superior; BurkeFilm.
 - g. Euclid Chemical Company (The), an RPM company; Eucobar.
 - h. Kaufman Products, Inc.; Vapor-Aid.
 - i. Lambert Corporation; LAMBCO Skin.
 - j. L&M Construction Chemicals, Inc.; E-CON.
 - k. Meadows, W. R., Inc.; EVAPRE.
 - l. Metalcrete Industries; Waterhold.
 - m. Nox-Crete Products Group; MONOFILM.
 - n. Sika Corporation; SikaFilm.
 - o. SpecChem, LLC; Spec Film.
 - p. Symons by Dayton Superior; Finishing Aid.
 - q. TK Products, Division of Sierra Corporation; TK-2120 TRI-FILM.
 - r. Unitex; PRO-FILM.
 - s. Vexcon Chemicals, Inc.; Certi-Vex Envio Set.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
- a. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
 - b. BASF Construction Chemicals - Building Systems; Kure 200.
 - c. ChemMasters; Safe-Cure Clear.
 - d. Conspec by Dayton Superior; W.B. Resin Cure.
 - e. Dayton Superior Corporation; Day-Chem Rez Cure (J-11-W).
 - f. Edoco by Dayton Superior; Res X Cure WB.
 - g. Euclid Chemical Company (The), an RPM company; Kurez W VOX; TAMMSCURE WB 30C.
 - h. Kaufman Products, Inc.; Thinfil 420.

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- i. Lambert Corporation; AQUA KURE - CLEAR.
- j. L&M Construction Chemicals, Inc.; L&M Cure R.
- k. Meadows, W. R., Inc.; 1100-CLEAR.
- l. Nox-Crete Products Group; Resin Cure E.
- m. Right Pointe; Clear Water Resin.
- n. SpecChem, LLC; Spec Rez Clear.
- o. Symons by Dayton Superior; Resi-Chem Clear.
- p. TK Products, Division of Sierra Corporation; TK-2519 DC WB.
- q. Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.

2.8 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

2.9 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 - 1. Fly Ash: 25 percent.
 - 2. Combined Fly Ash and Pozzolan: 25 percent.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
 - 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 - 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
 - 4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

2.10 CONCRETE MIXTURES FOR BUILDING

- A. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:
 - 1. Minimum Compressive Strength: 3000 psi at 28 days.
 - 2. Slump Limit: 4 inches.

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3. Air Content: 5 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.

2.11 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.12 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and furnish batch ticket information.
 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
 1. Class B, 1/4 inch for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 1. Install keyways, reglets, recesses, and the like, for easy removal.
 2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Chamfer exterior corners and edges of permanently exposed concrete.
- H. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

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- I. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- J. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- K. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.

3.3 VAPOR RETARDERS

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
 - 1. Lap joints 6 inches and seal with manufacturers recommended tape.

3.4 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

3.5 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by COR

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- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
 - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 - 1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
 - 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 - 1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 2. Maintain reinforcement in position on chairs during concrete placement.
 - 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 - 4. Slope surfaces uniformly to drains where required.
 - 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- F. Hot-Weather Placement: Comply with ACI 301 and as follows:
 - 1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - 2. Fog-spray forms, steel reinforcement, and sub-grade just before placing concrete. Keep sub-grade uniformly moist without standing water, soft spots, or dry areas.

3.6 FINISHING FORMED SURFACES

- A. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces exposed to public view.
- B. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:
 - 1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

3.7 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, re-straightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
 - 1. Apply float finish to the Hazardous Material Building slab.
 - 2. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft-long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/4 inch
- C. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
 - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with COR before application.

3.8 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

3.9 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
 - 2. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound.
 - 3. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.10 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by COR. Remove and replace concrete that cannot be repaired and patched to COR's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 - 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 - 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
 - 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 - 2. After concrete has cured at least 14 days, correct high areas by grinding.
 - 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 - 4. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to COR's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to COR's approval.

3.11 FIELD QUALITY CONTROL

- A. Testing and Inspecting: The COR will perform the following inspections:
 - 1. Inspect formwork
 - 2. Steel reinforcement
 - 3. Concrete placement, include conveying and depositing.
- B. Testing and Inspecting: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

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C. Inspections:

1. Verification of concrete strength before anchoring the Hazardous Material Building. The concrete samples shall test at 70% of the 28 day strength before anchoring.

D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd.
2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31/C 31M.
 - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
 - b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
 - a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
 - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
7. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
9. Test results shall be reported in writing to COR, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
10. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by the COR. Testing and inspecting agency

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may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by the COR.

11. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
12. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

END OF SECTION 033000

SECTION 133423 - FABRICATED STRUCTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes prefabricated steel hazardous material storage building
- B. Related Sections:
1. Division 03 Section "Cast-in-Place Concrete" for installing anchor bolts.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Hazardous Materials Storage Building shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to Factory Mutual
1. Floor Load: 500 PSF.
 2. Sump Loads: 1000+ PSF.
 3. Door Loads: 25 PSF.
 4. Wind Loads: 130-MPH Exp C.
 5. Fire Rating: 2hr fire rating unidirectional
 6. Sump liquid capacity 25% of liquid storage capacity

1.4 SUBMITTALS

- A. Product Data: For the Hazardous Materials Storage Building. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for Hazardous Materials Storage Building.
- B. Shop Drawings: For Hazardous Materials Storage Building Include plans, elevations, sections, details, foundation plans and anchorage details.
- C. Warranty: Sample of the Building Warranty.
- D. Approval or Certification that the design meets State of Florida requirements for anchorage wind resistance, and hazardous material containment.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Provide approvals that meet State of Florida design requirements for Hazardous Material Storage Buildings.

1.6 COORDINATION

- A. Coordinate installation of anchorages for the Hazardous Materials Storage Building. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.7 WARRANTY

- A. See Division 1

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, commercial quality, coating designation; mill phosphatized.
- B. Steel Structural Tubing: ASTM A 500, Grade B.
- C. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- D. Steel Mechanical Tubing: ASTM A 513 welded steel mechanical tubing.
- E. Zinc-Coated (Galvanized) Steel: Hot-dip galvanized according to ASTM A 123/A 123M.
- F. Stainless-Steel Sheet: ASTM A 666, Type 304.
- G. Metal Bar Grating : NAAMM MBG 531
- H. Anchorages: Anchor bolts; ASTM E 488. Type 316 Stainless Steel

2.2 PREFABRICATED STEEL HAZARDOUS MATERIALS STORAGE BUILDING

- A. Basis-of-Design Product: Subject to compliance with requirements, provide US Chemical Storage FireLoc FL1208 or comparable product by another manufacturer.
- B. WALL STRUCTURAL FRAMEWORK: Two (2) hour fire rated noncombustible weatherproof construction that meets or exceeds UL263 & ASTM E-119, with multiple layers of UL

Classified fire-resistant gypsum wallboard encased between exterior 12 gauge steel and interior heavy gauge Galvanneal sheet steel for maximum durability. Gypsum wallboard layers are offset with overlapping joints for maximum fire resistance. Conforms to NFPA 30 standards. Structure fabricated from 3" x 2" x 1/8" steel structural or mechanical tubing members placed on 24-inch on center. Building perimeter shall have 6"x3"x3/16" steel tubing below and above wall studs. The corner studs and door frame opening studs shall be 3"x3"x3/16". Framework connected by welding. Exterior sheets are connected to wall framework at each seam with a continuous weld. All framing members shall be mechanical or structural tubing; formed channels or studs are not acceptable.

- C. ROOF SYSTEM: Two (2) hour fire rated Class A flame spread rating; wind uplift exceeds UL Rating I-60 and constructed of 2-hour fire rated weather proof noncombustible construction same as building walls. The Roof Structural System is fabricated from 3.5" x 3.5" x 1/8" structural steel or mechanical tubing. Roof supports installed 24" inches on center. Exterior roof sheets are continuously welded to roof supports at each seam. All framing members are mechanical or structural tubing; formed channels or studs are not acceptable. 12 gauge steel roof with multiple layers of UL Classified fire resistant gypsum wallboard lined with heavy gauge Galvanneal steel sheets. Meets or exceeds UL 263 & ASTM-E119. Roof sloped to facilitate rain run off and equipped with rain shield over door(s).
- D. FLOOR SYSTEM: Grating and Leak Proof Spill-Containment Sump Assembly is a 6" inch high assembly consisting of 1" inch deep welded steel floor grating over 6" inch deep leak proof secondary containment sump. Continuous steel floor grating throughout building, fabricated from welded steel grating with 1 x 3/16" bearing bars at 1 x 3/16" inches on center and crossbars at 4 inches on center. Grating material is galvanized steel. Sump is fabricated utilizing continuously welded 10 gauge steel sheets for maximum spill containment. Chemical-resistant acrylic alkyd enamel coating is applied to secondary containment sump. Floor System is fabricated to comply with NAAMM MBG 531, "Metal Bar Grating Manual for Steel, Stainless Steel, and Aluminum Gratings and Stair Treads."
- E. BUILDING BASE: Open channel construction, underside coated with chemical resistant corothane I-Coal Tar for maximum corrosion resistance. Forklift pockets and hold-down brackets for ease of off-loading and relocation. Building base framing is capable of withstanding 1000 psf minimum. The building base is constructed in this manner to ensure the fork lifting, loading, transporting, offloading, and relocation do not affect this chemical storage building. This is to ensure the door openings remain square after lifting the building multiple times with a crane or fork trucks. The building base assembly shall consist of the following materials: 6 x 4 x 3/16" rectangular tubing, Hold Down Brackets welded to building are 1/2" thick plate steel angles, Floor Channel C 4x5.4, Floor Channel C6x8.2, and 4 x 2 x 1/8" rectangular tubing.
- F. One Roll up Door 5'W x 7'H 4 Hour Fire Rated UL Listed, Heavy duty four hour fire rated non-insulated galvanized steel rolling service door. Chain operated Includes bottom bar brush seal, guide brush seal, exterior sloped hood, and pad lockable slide bolt. The door shall be on the long side of the building
- G. Light Duty Load Center - UL Listed, Single Phase, 3 Wire, 120/240V 100 Amp Capacity Load Center (NEMA 3R) 6 space. Rainproof and Sleet- (Ice-) Resistant-Outdoor enclosures are intended for use outdoors to protect the enclosed equipment against rain and meet the requirements of Underwriters' Laboratories, Inc., Publication No. UL 508, applying to "rainproof Enclosures"

- H. STATIC GROUNDING SYSTEM: One exterior grounding connection. See drawings for grounding connections.
- I. One Explosion Proof Incandescent Light Fixture(s) - Interior - UL listed Class 1 Div 1 & 2 Groups C, D, Class 2 Div 1 & 2 Groups E, F, and G. Class 3 Div 1 & 2.
- J. One Fire Alarm Horn/Strobe – 24-Volt unit provides audible and visual signals.
- K. Heat Sensor - Explosion Proof - Qty 1 U.L. Listed explosion proof heat sensor sends signal when temperature reaches 194 deg. F, 120 Volt, mounts vertically on ceiling
- L. Explosion Proof Electromechanical Exhaust Ventilation System consisting of One (1) UL Listed, Class I, Division 1, Group C and D Totally Enclosed Motor (115VAC, 4.5A, 60Hz, 1-Phase) with Non-Static Twelve-Inch (12) Diameter Cast Aluminum Fan Blade. External Housing Constructed of 18 GA Steel, Epoxy-Coated outside. Exhaust Intake Vents Located within Twelve Inches (12) of the Floor. System Activated by an Exterior UL Listed Fan Switch and a thermostat activated switch with a set range of 90 degrees F to 120 degree F Exterior Exhaust Fan Port Opening Equipped with Shutter Assembly and Screen. Mechanical vent is sized to allow for a minimum of 6 air changes per hour.
- M. GRAVITY AIR FLOW VENTS: UL listed with 1-1/2 hour rated fire dampers with UL listed 165 degree fusible links. Dampers include louvers and screens to provide airflow and have a galvanized steel frame and curtain type galvanized steel blades.
- N. Two Florida Approved Drainable Blade Louver. Florida Product Approved drainable blade louver designed to protect air intake and exhaust openings in building exterior walls. Qualified for wind-loads up to 200 PSF. Florida Product Approval No. FL6876.3
- O. Fabricate HAZARDOUS MATERIALS STORAGE BUILDING completely in factory.
- P. Wire HAZARDOUS MATERIALS STORAGE BUILDING at factory, ready for connection to service at Project site.

2.3 FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.4 FINISHES

- A. Steel and Galvanized-Steel Factory Finish Building Finish: After an extensive cleaning process the interior and exterior surfaces are protected with a high solids alkyd universal metal primer (primer) and a high solid acrylic alkyd enamel top coat providing proven interior chemical resistance as well as exterior abrasion, corrosion, UV resistance and exceptional durability..
 - 1. Color: Select from the Manufacturers available colors.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install HAZARDOUS MATERIALS STORAGE BUILDING according to manufacturer's written instructions.
- B. Set HAZARDOUS MATERIALS STORAGE BUILDING plumb and aligned. Level base plates true to plane with full bearing on concrete bases.
- C. Fasten Hazardous Materials Storage Building securely to concrete base with expansion anchors.
- D. Connect electrical power service to power distribution system according to requirements specified in Division 16 Sections.

3.3 ADJUSTING

- A. Adjust doors, and hardware to operate smoothly, easily, properly, and without binding. Confirm that locks engage accurately and securely without forcing or binding.
- B. Lubricate hardware and other moving parts.
- C. After completing installation, inspect exposed finishes and repair damaged finishes.

END OF SECTION 133423

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SECTION 16100 – RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes raceways, fittings, and boxes, for electrical wiring.
- B. Raceways include the following:
 - 1. Flexible metal conduit(FMC).
 - 2. Rigid galvanized steel (RGS).
 - 3. Liquidtight flexible metal conduit(LFMC).
- C. Boxes, enclosures, and cabinets include the following:
 - 1. Device boxes.
 - 2. Outlet boxes.
 - 3. Pull and junction boxes.

1.2 REFERENCE STANDARDS

- A. American National Standards Institute (ANSI)
 - 1. C80.1: Rigid Steel Conduits
- B. Federal Standards (FS)
 - 1. W-C-586: Conduit outlet boxes, bodies, and entrance caps.
 - 2. W-C-566 Flexible Metal Conduit.
- C. National Electrical Contractors Association (NECA)
- D. National Electrical Manufacturers Association (NEMA)
 - 1. OS1: Sheet-steel outlet boxes, device boxes, covers, and box supports.
- E. National Fire Protection Association (NFPA)
 - 1. 70: National Electrical Code (NEC).
- F. Underwriters Laboratories (UL)
 - 1. 1: Flexible metal conduit.
 - 2. 50: Enclosures for electrical equipment.
 - 3. 486A: Wire connectors for use with copper conductors.
 - 4. 514A: Metallic outlet boxes.
 - 5. 514B: Fittings for conduit and outlet boxes.
 - 6. 6: Rigid metal conduits.

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1.3 SUBMITTALS

- A. Product catalog cut data for raceway, fittings and boxes. Identify each selection to show compliance with spec.

1.4 QUALITY ASSURANCE

- A. Comply with latest edition of the NFPA 70 "National Electrical Code" for components and installation.
 - 1. Boxes shall be sized in accordance with NEC Article 370.
- B. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
 - 1. The Terms "Listed and Labeled": As defined in the "National Electrical Code," Article 100.
 - 2. Listing and Labeling Agency Qualifications: A NRTL as defined in OSHA Regulation 1910.7.
- C. Comply with NECA "Standard of Installation."
- D. Coordinate layout and installation of raceway and boxes with other construction elements to ensure adequate headroom, working clearance, and access.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Enclosures shall conform to NEMA standards.

2.2 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering Products that may be incorporated in the Work include, but are not limited to, the following:
 - 1. Metal Conduit and Tubing:
 - a. Allied Tube and Conduit, Grinnell Co.
 - b. Wheatland
 - 2. Conduit Bodies and Fittings:
 - a. Emerson Electric Co., Appleton Electric Co.
 - b. Hubbell, Inc., Killark Electric Manufacturing Co.
 - c. General Signal, O-Z/Gedney Unit.
 - d. Crouse Hinds
 - 3. Boxes, Enclosures, and Cabinets:
 - a. Hoffman Engineering Co., Federal-Hoffman, Inc.
 - b. General Signal, O-Z/Gedney.
 - c. Racal, Inc., Hubbell Inc.
 - d. Spring City Electrical Manufacturing Co.

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- e. Thomas & Betts Corp/ Steel City.
- f. Crouse Hinds

2.3 METAL CONDUIT AND TUBING

- A. Galvanized Rigid Steel Conduit: ANSI C80.1
- B. Flexible Metal Conduit; Zinc-coated steel: UL 1 and Federal Specification WW-C-566.
 - 1. Conduit connectors shall be threaded with insulated throat. Use Steel City XC-342.
- C. Fittings: UL 514B and NEMA FB 1, compatible with conduit and of the threaded type. Set Screw fittings are not allowed.

2.4 OUTLET AND DEVICE BOXES

- A. Sheet Metal Boxes: NEMA OS 1 and UL 514A.
- B. Flush Outlet Boxes: UL 514A hot-dip galvanized steel, 2-1/8 inches deep by four inches square, with extension ring where necessary.
- C. Boxes for exterior lighting fixtures: Surface mounted waterproof with gasket from floodlight manufacturer as noted on the plans..
- D. Fittings: UL 514B

2.5 PULL AND JUNCTION BOXES

- A. Small Sheet Metal Boxes: NEMA OS 1 and UL 514A.
- B. Cast Metal boxes, gasketed
 - Type FSCT/FSD
 - Type LB

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to receive raceways and boxes, for compliance with installation tolerances and other conditions affecting performance of the raceway system. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. Examine raceways prior to installation. No crushed or deformed raceway shall be installed.

3.2 WIRING METHODS

- A. Indoors: Use the following wiring methods:
 - 1. Rigid galvanized steel conduit shall be used for all panelboard feeders and branch circuits.
 - 2. Flexible steel metal conduit shall be used under computer raised floors as noted on the drawings.

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3. Boxes and Enclosures: NEMA Type 1

B. Outdoors and underground:

1. Rigid galvanized steel conduit and fittings with PVC coating.
2. LMFC(sealtite) to exterior light fixtures per drawing details.

3.3 INSTALLATION

- A. Install raceways, boxes, as indicated, according to manufacturer's written instructions. Install to withstand seismic forces per IBC 2003 Group B Category II as indicated in Section 16190, "Supporting Devices."
- B. The minimum size raceway shall be 3/4 inch except for exterior lighting LFMC shall be 1/2 inch.
- C. RACEWAYS:
 1. Raceways shall not be attached to the ceiling suspension system.
 2. Do not anchor or strap raceways to wall furring channels or to other raceways.
- D. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot water pipes. Install horizontal raceway runs above water and steam piping.
- E. Install raceways level and square and at proper elevations. Provide adequate headroom.
- F. Complete raceway installation before starting conductor installation. Raceways shall be fished and swabbed before conductors are pulled.
- G. Support raceways and boxes as specified in Section 16190 "Supporting Devices."
 1. Boxes for fixtures on suspended ceilings shall be supported independently of the ceiling supports.
 2. Boxes shall not be supported from sheet-metal roof decks.
- H. Use temporary closures to prevent foreign matter from entering raceway.
- I. Make bends and offsets so the inside diameter is not reduced. Unless otherwise indicated, keep the legs of a bend in the same plane and the straight legs of offsets parallel. No run shall contain more than four (4) 90 degree bends, or the equivalent. Provide pull-boxes, junction boxes, and conduit bodies as required to meet the bends criteria.
- J. Use raceway fittings compatible with raceway and suitable for use and location.
- K. Run concealed raceways with a minimum of bends in the shortest practical distance considering the type of building construction and obstructions, except as otherwise indicated.
- L. Wall Penetrations:
 1. Penetrations through walls shall be sealed.
- M. Join raceways with fittings designed and approved for the purpose and make joints tight.
 1. Use insulating bushings for all conduits to protect conductors.

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- N. Terminations: Where raceways are terminated with locknuts and bushings, align the raceway to enter squarely, and install the locknuts with dished part against the box. Where terminations cannot be made secure with one locknut, or where conduits enter enclosures without threaded hubs, use two locknuts, one inside and one outside the box to securely bond the conduit to the enclosure. In addition a bushing shall be installed on the interior threaded end of the conduit to protect conductor insulation.
- O. Where terminating in threaded hubs, screw the raceway or fitting tight into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align the raceway so the coupling is square to the box, and tighten the chase nipple so no threads are exposed.
- P. Metal conduits shall be mechanically and electrically continuous between outlets, junction and pull boxes, panels, cabinets and similar equipment. Conduits shall enter and be secured to enclosures so that each system is electrically continuous throughout.
- Q. Provide grounding connections for raceway, boxes, and components. Tighten connectors and terminals, including screws and bolts according to equipment manufacturer's published torque tightening values. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals according to tightening torques specified in UL Standard 486A.
 - 1. Provide grounding bushings for all feeder conduits at switchgear, switchboards, motor control centers, panelboards, transformers, pull boxes, and all other termination points.
 - 2. Where knockouts are used, provide double locknuts, one on each side with a grounding bushing or grounding locknut used on the inside (use grounding bushings on conduit 1" and larger).
- R. Field Cut Conduit: Where conduit has to be cut in the field, it shall be cut square using a hand or power hacksaw or approved pipe cutter using cutting knives. The cut ends of the field-cut conduit shall be reamed to remove burrs and sharp edges.
- S. Boxes: Shall be provided in the wiring or raceway system for pulling wires, making connections, and mounting devices or fixtures. Each box shall have the volume required by NFPA 70 for the number and size of conductors in the box.
 - 1. Outlet boxes: Each outlet box shall have a machine screw which fits into a tapped hole in the box for the ground connection.
 - 2. Mounting light fixtures: Boxes for mounting fixtures shall be not less than 4 inches square.
 - 3. Concealed wiring: Boxes installed for concealed wiring shall be provided with extension rings or plaster covers. The front edge of the box shall be flush or recessed not more than 1/4" from the finished wall surface.
- T. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line having not less than 200-lb. tensile strength. Leave not less than 12 inches of slack at each end of the pull wire.

3.4 CLEANING

- A. Upon completion of installation of system, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

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END OF SECTION 16100

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SECTION 16120 - WIRES AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes building wires and cables and associated splices, connectors, and terminations for wiring systems rated 600 volts and less.

1.2 REFERENCE STANDARDS

- A. National Electrical Manufacturers Association (NEMA)

WC5: Thermoplastic insulated wire and cable for the transmission and distribution of electrical energy.

- B. Federal Standards (FS)

- 1. W-S-610: Splice connectors
- 2. QQ-W-343: Wire, electrical, copper, insulated.

- C. National Electrical Contractors Association (NECA)

- 1. Standard of Installation

- D. National Fire Protection Association (NFPA)

- 1. 70: National Electrical Code (NEC).

- E. Underwriters Laboratories (UL)

- 1. 486A: Wire connectors for use with copper conductors.
- 2. 486C: Splicing wire connectors.

1.3 SUBMITTALS

- A. Product data for wires and cables. Provide catalog cuts with selections identified to show compliance with spec.

1.4 QUALITY ASSURANCE

- A. Comply with NFPA 70, NEC, for components and installation.

- B. Listing and Labeling: Provide products specified in this Section that are listed and labeled.

- 1. The Terms "Listed and Labeled": As defined in the NEC, Article 100.
- 2. Listing and Labeling Agency Qualifications: A NRTL as defined in OSHA Regulation 1910.7.

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1.5 SEQUENCING AND SCHEDULING

- A. Coordination: Coordinate layout and installation of cable with other installations.
 - 1. Revise locations and elevations from those indicated as required to suit field conditions and as approved by the COR.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wire and cable according to NEMA WC-26.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
 - 1. Wires and Cables:
 - a. American Insulated Wire Corporation, Leviton Manufacturing Co.
 - b. Brand-Rex Cable Systems, Brintec Corp.
 - c. Carol Cable Company, Inc.
 - d. Senator Wire & Cable Co.
 - e. Southwire Co.
 - 2. Connectors for Wires and Cables:
 - a. AFC, Monogram Co.
 - b. AMP, Inc.
 - c. Anderson, Square D Co.
 - d. Electrical Products Division, 3M Co.
 - e. O-Z/Gedney Unit, General Signal.

2.2 BUILDING WIRES AND CABLES

- A. UL-listed building wires and cables with conductor material, insulation type, cable construction, and rating as specified in Part 3.2 "Applications" Article.
- B. Thermoplastic Insulation: Conform to NEMA WC 5.
- C. Solid conductor for 10 AWG and smaller; stranded conductor for larger than 10 AWG.
- D. All wire and conduit sizes are based on copper conductors per NEC 70.

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- E. Size: Minimum 12 AWG. Minimum 10 AWG for 120 volt circuits where circuit length (one way) exceeds 75 feet from source, and 10 AWG for 277 volt circuits where circuit length (one way) exceeds 150 feet from source.
- F. Material: Copper only
- G. Conductor Color Codes:
 - 1. Feeder conductors to panels and three phase circuits shall be factory color coded as indicated:
 - a. 208/120 Volt System:
 - 1)Phase A: Black
 - 2)Phase B: Red
 - 3)Phase C: Blue
 - 4)Neutral: White
 - 5)Ground: Green
 - b. 480/277 Volt System:
 - 1)Phase A: Yellow
 - 2)Phase B: Brown
 - 3)Phase C: Orange
 - 4)Neutral: Grey
 - 5)Ground: Green
 - 2. Single-phase branch circuits shall be factory color coded as stated above.

2.3 CONNECTORS AND SPLICES

- A. UL-listed factory-fabricated wiring connectors of size, ampacity rating, material, and type and class for application and for service indicated. Select to comply with Project's installation requirements and as specified in Part 3.2 "Applications" Article.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine raceways and building finishes to receive wires and cables for compliance with installation tolerances and other conditions. Verify that the duct or conduit is open, continuous, and clear of debris before installing cable. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

- A. Indoor Branch Circuits: Type THHN/THWN, copper conductor, 75 degree C insulation rating in raceway.
- B. Exterior Branch Circuits: Type THHN/THWN, copper conductor, 75 degree C insulation rating in raceway.

C. Feeders: Type THHN/THWN, copper conductor, 75 degree C rating insulation in raceway.

3.3 INSTALLATION

- A. Install wires and cables as indicated, according to manufacturer's written instructions and the NECA "Standard of Installation."
- B. Pull conductors into raceway simultaneously where more than one is being installed in same raceway.
 - 1. Use pulling compound or lubricant where necessary; compound used must not deteriorate conductor nor insulation, and must be non-flammable.
 - 2. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.
- C. Cable shall be installed in a manner to prevent harmful stretching of the conductor, injury to the insulation or damage to the outer protective covering.
- D. The ends of cables shall be sealed with moisture-seal tape before pulling, and shall be left sealed until connections are made.
- E. Conductor Splices:
 - 1. Splices shall be made only at outlets, junction boxes, or accessible raceways.
 - 2. Splices shall be made with solderless connectors conforming to FS W-S-610.
 - 3. Wire nuts may only be used to splice conductors sized No. 10 AWG and smaller.
 - 4. Compression connectors shall be used to splice conductors No. 8 and larger.
 - 5. All splices, including those made with insulated wire nuts, shall be insulated with electrical tape or heat-shrink tubing to a level equal to that of the factory insulated conductors.
 - 6. Splicing of existing ungrounded feeder conductors in new panelboards if shown on the drawings is permitted using approved insulated multi -cable connector blocks (i.e. "Polaris).
 - 7. Splices shall be made with solderless connectors conforming to UL 486A, UL 486C, and UL 486E.
 - 8. Install splices and insulating tapes that possess equivalent or better mechanical strength and insulation ratings than conductors being spliced.
 - 9. Use splice and tap connectors that are compatible with conductor material.
 - 10. Splicing methods and material shall be of a type recommended by the manufacturer of the splicing material for the particular type of cable being spliced and shall be approved by the COR prior to installation.
 - 11. Critical power feeders and branch circuits shall not be spliced.
- F. Wiring at Outlets: Install with at least 3 inches of slack conductor at each outlet, per NEC 300.14.
- G. Connect outlets and components to wiring and to ground as indicated. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals according to tightening torques specified in UL Standard 486A.

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- H. Conductors for emergency lighting, telco/LAN, security, and sprinkler alarm systems shall be kept completely independent from any other system as well as each other.
- I. A splice shall not be pulled into a duct or conduit under any circumstance.
- K. Separate neutral and ground wires shall be provided for each overcurrent protection device. Each branch circuit shall have its own neutral and ground conductor. Common neutral or ground conductors are not acceptable.
- L. Install conductors only after the raceway system is complete.
- M. Identify each circuit phase conductor and associated neutral with "Brady" markers each end to designate associated panelboard circuit breaker.

3.4 FIELD QUALITY CONTROL

- A. Insulation Resistance Tests: Feeder and Branch Circuit insulation tests shall be performed after installation, but before connection to equipment.
 - 1. Conductors shall test free from short circuits and grounds, and have a minimum phase-to-phase and phase-to-ground insulation resistance of 30 megohms when measured with a 500-volt DC insulation resistance. The contractor shall submit a letter type test report to the COR prior to final inspection of the Work. The report shall list the tests performed and results obtained.
 - 2. Contractor shall use Megger Test Report Form form located at the end of this section.
- B. Correct malfunctioning products at site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units, and retest.

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SECTION 16190 - SUPPORTING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes secure support from the building structure for electrical items by means of hangers, supports, anchors and associated fastenings.

1.2 REFERENCE STANDARDS

- A. National Fire Protection Association (NFPA)
 - 1. 70: National Electrical Code (NEC)

- B. Underwriters Laboratories (UL)

1.3 SUBMITTALS

- A. Product catalog cut data for each type of product specified with selection identified to show compliance with specifications.
- B. Shop drawings of supports to meet seismic requirements for IBC 2003 Group B Category II.

1.4 QUALITY ASSURANCE

- A. Electrical Component Standard: Components and installation shall comply with NFPA 70.
- B. Electrical components shall be listed and labeled by UL or other approved, nationally recognized testing and listing agency that provides third-party certification follow-up services.

PART 2 - PRODUCTS

2.1 COATINGS

- A. Coating: Supports, support hardware, and fasteners shall be protected with zinc coating or with treatment of equivalent corrosion resistance using approved alternative treatment, finish, or inherent material characteristic.

2.2 MANUFACTURED SUPPORTING DEVICES

- A. Raceway Supports: Clevis hangers, riser clamps, conduit straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring steel clamps.
- B. Fasteners: Types, materials, and construction features as indicated.
- C. U-Channel Systems: 16-gage steel channels, with 9/16-inch-diameter holes, at a minimum of 8 inches on center, in top surface. Provide fittings and accessories that mate and match with U-channel and are of the same manufacture.

- D. Support systems shall be capable of carrying the weight of the box and its contents.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install supporting devices to fasten electrical components securely and permanently in accordance with NEC requirements.
- B. Raceway Supports: Comply with the NEC and the following requirements:
 - 1. Neither raceways nor boxes shall be fastened to suspended ceiling supports.

END OF SECTION 16190

SECTION 16195 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes identification of electrical materials, equipment, and installations.

1.2 REFERENCE STANDARDS

- A. Applicable only to the extent specified.
- B. American National Standards Institute (ANSI)
 - 1. A 13.1: Scheme for the Identification of Piping Systems.
 - 2. C2: National Electrical Safety Code.
- C. National Fire Protection Association (NFPA)
 - 1. 70: National Electrical Code (NEC).

1.3 SUBMITTALS

- A. Samples for each color, lettering style, and other graphic representation required for tubing, tags, labels, markers, and other identification materials; samples of labels and signs.
- B. Shop drawings showing installation method for each type of identification device.

1.4 QUALITY ASSURANCE

- A. Components and installation shall comply with NFPA 70.
- B. Comply with the requirements of ANSI A13.1 with regard to type and size of lettering for raceway and cable labels.

1.5 SEQUENCING AND SCHEDULING

- A. Coordinate installing electrical identification after completion of finishing where identification is applied to field-finished surfaces.
- B. Coordinate installing electrical identifying devices and markings prior to installing acoustical ceilings and similar finishes that conceal such items.

PART 2 - PRODUCTS

2.1 RACEWAY AND CABLE LABELS

- A. Manufacturer's Standard Products: Where more than one type is listed for a specified application, selection is Installer's option, but provide single type for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, and these Specifications.
- B. Conform to ANSI A13.1, Table 3, for minimum size of letters for legend and minimum length of color field for each raceway or cable size.
 - 1. Color: Black legend on orange field.
 - 2. Legend: Indicates voltage and service.
- C. Adhesive Labels: Preprinted, flexible, self-adhesive vinyl. Legend overlaminated with clear, weather- and chemical-resistant coating.
- D. Heat Shrink Tubing: Preprinted, embossed, permatized, 20-year life. Size to suit conductors; lettering shall be legible after heat shrinking.
- E. Pretensioned, Wraparound Plastic Sleeves: Flexible, preprinted, color-coded, acrylic bands sized to suit the diameter of the line it identifies and arranged to stay in place by pretensioned gripping action when placed in position.
- F. Colored Adhesive Tape: Self-adhesive vinyl tape not less than 3 mils thick by 1 inch wide.
- G. Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound type with pre-printed numbers and letters.
- H. Plasticized Card-stock Tags: Vinyl cloth with pre-printed legends. Orange background, except as otherwise indicated, with eyelet for fasteners.
- I. Brass Tags: Metal tags with stamped legend, punched for fasteners. Dimensions: 2 inches by 2 inches by 0.05 inch.

2.2 ENGRAVED NAMEPLATES AND SIGNS

- A. Manufacturer's Standard Products: Where more than one type is listed for a specified application, selection is Installer's option, but provide single type for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, and these Specifications.
- B. Engraving Stock: melamine plastic laminate, 1/16-inch minimum thick for signs up to 20-sq. in., 1/8 inch thick for larger sizes.
 - 1. Engraved Legend: White letters on black field.

2. Punched for mechanical fasteners.
- C. Interior Warning and Caution Signs: Pre-printed aluminum, baked enamel finish with 1/4-inch grommets in corners for mounting.
 1. Color, size and legend: appropriate to the application.
 2. Punched for fasteners.
- D. Exterior, Metal-Backed, Butyrate Signs: Weather-resistant, non-fading, preprinted, cellulose acetate butyrate signs with 0.0396-inch, galvanized steel backing, with colors, legend, and size appropriate to the application. 1/4-inch grommets in corners for mounting.
- E. Fasteners for Plastic-Laminated and Metal Signs: Self-tapping stainless-steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.

2.3 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6-nylon cable ties with the following features:
 1. Minimum Width: 3/16 inch.
 2. Tensile Strength: 50-lb. minimum.
 3. Temperature Range: Minus 40 to 185 deg F.
 4. Color: As indicated where used for color-coding.
- B. Paint: Alkyd-urethane enamel over primer as recommended by enamel manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install identification devices according to manufacturer's written instructions.
- B. Install labels where indicated and at locations for best convenience of viewing without interference with operation and maintenance of equipment.
- C. Lettering, Colors, and Graphics: Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations used in the Contract Documents or required by codes and standards. Use consistent designations throughout the Project.
- D. Sequence of Work: Where identification is to be applied to surfaces that require finish, install identification after completion of finish work.
- E. Self-Adhesive Identification Products: Clean surfaces of dust, loose material, and oily films before applying.

F. Install painted identification as follows:

1. Clean surfaces of dust, loose material, and oily films before painting.
2. Prime Surfaces: For galvanized metal, use single-component, acrylic vehicle coating formulated for galvanized surfaces. For concrete masonry units, use heavy-duty, acrylic-resin block filler. For concrete surfaces, use clear, alkali-resistant, alkyd binder-type sealer.
3. Apply one intermediate and one finish coat of silicone alkyd enamel.
4. Apply primer and finish materials according to manufacturer's instructions.

G. Identify Raceways with Color Banding: Band exposed and accessible raceways of the systems listed below for identification.

1. Bands: Pretensioned, snap-around, colored plastic sleeves; colored adhesive tape; or a combination of both. Make each color band 2 inches wide, completely encircling conduit, and place adjacent bands of 2-color markings in contact, side by side.
2. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25 feet in congested areas.
3. Colors: As follows:
 - b) Fire-Suppression Supervisory and Control System: Red and yellow.
 - c) Security System: Blue and yellow.
 - d) Mechanical and Electrical Supervisory System: Green and blue.
 - e) Telecommunications System: Green and yellow.

H. Install Circuit Identification Labels on Boxes: Label externally as follows:

1. Exposed Boxes: Pressure-sensitive, self-adhesive plastic label on cover.
2. Concealed Boxes: Plasticized card-stock tags.
3. Labeling Legend: Permanent, waterproof listing of panel and circuit number or equivalent.

I. Color-Code Conductors: The following field-applied color-coding methods may be used in lieu of factory-coded wire listed in Section 16120 "Wires and Cables" for sizes larger than No. 4 AWG. Contractor shall demonstrate non-availability of factory colored wire before using this application.

1. Colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply the last 2 turns of tape with no tension to prevent possible unwinding. Use 1-inch-wide tape in colors as specified. Adjust tape bands to avoid obscuring cable identification markings.
 - a. Where conductors are color coded by this method, they shall be color coded in accessible raceways, panelboards, outlets, and switches, as well as at all terminations. Conductors in accessible raceways shall be color coded so that by removing or opening any cover, the coding will be visible.

- b. Phase, ground, and neutral conductors shall be color coded in accordance with Section 16120, "Wires and Cables."
 2. Green insulated conductors shall not be re-identified for purposes other than grounding.
 3. White or neutral gray conductors shall not be re-identified for purposes other than grounded neutrals.
- J. Apply identification to conductors as follows:
 1. Conduits and Conductors to Be Extended in the Future: Indicate source and circuit numbers.
 2. Power and Lighting Circuits at Enclosure and at terminations: Identify each conductor with panel designation, circuit number, voltage, and phase.
 3. Control and Communications Circuits at Enclosure and at terminations: Identify each conductor by its system and circuit designation. Use a consistent system of tags, color-coding, or cable marking tape.
- K. Apply warning, caution, and instruction signs and stencils as follows:
 1. Install warning, caution, and instruction signs where indicated or required to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions or explanations are needed for system or equipment operation.
 2. Emergency-Operating Signs: Install engraved laminate signs with white legend on red background with minimum 3/8-inch-high lettering for emergency instructions on power transfer, and other emergency operations.
- L. Install identification as follows:
 1. Apply equipment identification labels of engraved plastic laminate on each major unit of equipment, including central or master unit of each system. This includes communication, signal, and alarm systems, unless units are specified with their own self-explanatory identification. Provide equipment, required under Division 16, as follows: with nameplate indicating equipment name, system voltage(s) and phase (for example: EF203, 480V, 3 phase). Except as otherwise indicated, provide a single line of text with 1/2-inch-high lettering on 1-1/2-inch-high label; where 2 lines of text are required, use 2-inch-high label. Apply labels for each unit of the following categories of equipment:
 - a) Panelboards, electrical cabinets, and enclosures.
 - b) Access doors and panels for concealed electrical items.
 - c) Motor starters.
 - d) Control devices.
 2. Label conduit at each end and at pull boxes with characters a minimum 1/4-inch high.
 3. Apply designation labels of engraved plastic laminate for disconnect switches, breakers, push buttons, pilot lights, and similar items for power distribution and control components above, except panelboards and alarm/signal components where labeling is specified

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elsewhere. For panelboards, provide framed, typed circuit schedules with explicit description and identification of items controlled by each individual breaker.

END OF SECTION 16195

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SECTION 16452 - GROUNDING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes solid grounding of electrical systems and equipment and basic requirements for grounding for protection of life, equipment, circuits, and systems. Grounding requirements specified in this Section may be supplemented in other Sections of these Specifications.

1.2 REFERENCE STANDARDS

- A. National Fire Protection Association (NFPA)

- 1. 70: National Electrical Code (NEC).

- B. Underwriters Laboratories (UL)

- 1. 467: Grounding and bonding equipment.
 - 2. 486A: Wire connectors and soldering lugs for use with copper conductors.

1.3 SUBMITTALS:

- A. Product catalog cut data for grounding hardware. Identify selection to show compliance with the specification.

1.4 QUALITY ASSURANCE

- A. Comply with NFPA 70, National Electrical Code.

- B. Listing and Labeling: Provide products specified in this Section that are listed and labeled.

- 1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
 - 2. Listing and Labeling Agency Qualifications: A NRTL as defined in OSHA Regulation 1910.7.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ILSCO.
2. Kearney.
3. Thomas & Betts, Electrical.

2.2 GROUNDING AND BONDING PRODUCTS

- A. Products: Of types indicated and of sizes and ratings to comply with the NEC. Where types, sizes, ratings, and quantities indicated are in excess of requirements above, the more stringent requirements and the greater size, rating, and quantity indications govern.

2.3 WIRE GROUNDING CONDUCTORS

- A. Comply with Section 16120 "Wires and Cables." Conform to NEC Table 8, except as otherwise indicated, for conductor properties, including stranding.

1. Material: Copper. Use only insulated copper wire
2. Size: Minimum allowable size shall not be less than #12 AWG, in addition to compliance with NEC.

- B. Equipment Grounding Conductors: Insulated with green color insulation.

2.4 MISCELLANEOUS CONDUCTORS

- A. Raceway Bonding Jumpers: Copper, minimum size #6 AWG unless otherwise noted.

- B. Ground Strap: Provide a flexible ground strap, #6 AWG or braided equal, for electrical continuity at each flexible duct connection of each air handler, and fan.

PART 3 - EXECUTION

3.1 APPLICATION

- A. General: FAA grounding requirements often exceed those of NEC; therefore, grounding system shall be as indicated in Contract Drawings, and as specified herein.

- B. Equipment Grounding Conductors: All metallic non-current carrying parts of electrical equipment shall be grounded with equipment grounding conductors whether or not shown on the drawings. Equipment grounding conductors shall be green insulated copper conductors unless otherwise indicated. When these conductors are not sized nor shown on the Contract Drawings, size them in accordance with Table 250-122 of the NEC, "Minimum

Size Equipment Grounding Conductors for Grounding Raceway and Equipment. In no case, however, shall these conductors be smaller than No. 12 AWG.

1. Install green, equipment grounding conductor with all feeder and branch circuit conductors for each overcurrent device.

C. Conduit or cable shields shall not be used as the equipment grounding conductor.

3.2 INSTALLATION

- A. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps.

3.3 CONNECTIONS

- A. General: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to assure high conductivity and to make contact points closer in order of galvanic series.
2. Make connections with clean, bare metal at points of contact.

- B. Terminate insulated equipment grounding conductors for feeders with pressure-type grounding lugs. Where metallic raceways terminate at non-metallic or non-conductive housings, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to the ground bus in the housing. Bond electrically non-continuous conduits at both entrances and exits with grounding bushings and bare grounding conductors .

- C. Raceway Grounding: Surface metal raceways, wireways, or cable rack systems shall be installed in a manner that assures electrical continuity. Insulated copper bonding jumpers shall be installed between adjacent raceway sections to assure proper bonding. Uninsulated conductors shall not be used. Unless otherwise indicated, the minimum size for these bonding jumpers shall be No. 6 AWG. Where aluminum raceways are used, the jumpers shall be bonded with approved connectors for the dissimilar metals. All metallic raceway penetrations into a facility structure shall be bonded to the earth electrode system.

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3.4 SYSTEM AND EQUIPMENT GROUNDING

- A. Install a grounding conductor for each overcurrent device. The equipment grounding conductor shall be installed in the same conduit as the branch or feeder conductors. Grounding conductor shall have insulation rating equivalent to phase conductor insulation. Insulated grounding conductors shall be connected to the ground terminal at both ends and to junction, transition, pull and fixtures boxes along the route. Under no circumstances shall this conductor be omitted from the electrical system, nor shall a separate grounding system, such as the signal grounding, be used as a substitute.
- B. Metallic raceway housing the equipment grounding conductor shall be mechanically and electrically continuous.
- C. Where there are parallel conductors of a feeder installed in more than one raceway, install an equipment grounding conductor in each raceway.
- D. Ground the ends of all conduit runs using grounding bushings, except for receptacle and lighting branch circuits.
- B. Splices of grounding conductors inside conduits are not acceptable.

END OF SECTION 16452